
ADASS 2007
Astronomical Data Analysis Software and Systems
LONDON UK
Invited Speakers:
Jim Cordes (Cornell)
Ken Ganga (CNRS)
David Giaretta (STFC)
Alyssa Goodman (CfA, IIC)
Johannes Gutleber (CERN)
Warren Hack (STScI)
David Hogg (NYU)
Robert Mann (IfA, Edinburgh)
Vicent Martinez (Valencia)
Richard Mount (SLAC)
Meyer Pesenson (CalTech)
Frank Summers (STScI)
Tony Tyson (UCD)
23-26 September 2007
Kensington Town Hall, London SW7
Local Organising Committee:
Jim Lewis (chair)
Bob Argyle
Peter Bunclark
Dafydd Evans
Eduardo Gonzalez-Solares
Simon Hodgkin
Mike Irwin
Marco Riello
Science & Technology Facilities Council
http://adass.org/adass2007/

ADASS XVII Meeting Programme

		Sunday, 23 September	
11:00	20:00	Registration	Foyer
13:00	19:00	Poster/Demo Setup	
		Tutorial Sessions	Small Hall
13:00	15:15	3D Visualisation in Astronomy	J. Kauffmann
15:15	15:45	**Coffee Break**	
15:45	18:00	Data Mining in Astronomy	S. McConnell
19:00	21:00	**Opening Reception**	Main Foyer

		Monday, 24 September	
		Session 1: Data Preservation	Great Hall
08:30	08:45	Welcome, Opening Remarks	
08:45	09:15	Data Preservation and the Virtual Observatory	R. Mann (invited)
09:15	09:45	Trusted Data Repositories	D. Giaretta (invited)
09:45	10:00	Long-Term Preservation of Astronomical Research Results	R. Hanisch
10:00	10:15	Building a Framework for Data Preservation of Large-Scale Astronomical Data	J. Kantor
10:15	11:30	**Coffee Break, Poster & Demo Viewing**	
		Session 2: Footprints and Mosaics	Great Hall
11:30	12:00	Making the Sky Searchable: Automated Astrometry	D. Hogg (invited)
12:00	12:30	Automated Image Registration for the Future	W. Hack (invited)
12:30	12:45	**Conference Photo**	
12:45	14:00	**Lunch, Poster & Demo Viewing**	
		Session 3: HEP Computing	Great Hall
14:00	14:30	Data Acquisition in High-Energy Physics	J. Gutleber (invited)
14:30	15:00	Data Analysis in High Energy Physics, Weird or Wonderful?	R. Mount (invited)
15:00	15:15	GLAST LAT Computing: A Fusion of HEP and Astrophysics	R. Dubois
15:15	16:30	**Coffee Break, Poster & Demo Viewing**	
		Focus Demo 1	Small Hall
15:30	16:00	New Developments for Aladin	T. Boch
		Session 4a: Web Services and the Virtual Observatory	Great Hall
16:30	16:45	The NOAO NVO Portal and the Web 2.0	C. Miller
16:45	17:00	A Critical Point in the VO	D. Schade
17:00	17:15	Cloudspace: Virtual Environments in the VO	M. Graham
17:15	17:30	Workflow in Astronomy : the VO France Workflow Working Group Experience	A. Schaaff
		Session 4b: Image Processing and Mosaics	Small Hall
16:30	16:45	The NOAO Pipeline Applications	F. Valdes
16:45	17:00	The MONTAGE Service: Custom Mosaics on Demand	B. Berriman
17:00	17:15	Distributed Processing of Future Radio Astronomical Observations	G. van Diepen
17:15	17:30	LOFAR Self-Calibration using a Blackboard Software Architecture	M. Loose
17:30	19:30	**Dinner Break**	
		BoF 1.1	Great Hall
19:30	21:00	FITS	W. Pence
		BoF 1.2	Small Hall
19:30	21:00	Transient Event Reporting and Response with VOEvent	R. Seaman

		Tuesday, 25 September	
		Session 5: Algorithms and Image Processing I	Great Hall
08:30	09:00	PLANCK/HFI Data Analysis	K.Ganga (invited)
09:00	09:30	Image Processing Application for Cognition (IPAC)	M. Pesenson (invited)
09:30	10:00	LSST and the Dark Sector: Image Processing Challenges	T. Tyson (invited)
10:00	10:15	Organizing the Extremely Large LSST Database for Real-Time Astronomical Processing	J. Becla
10:15	11:15	**Coffee Break, Poster & Demo Viewing**	
		Session 6a: Algorithms and Image Processing II	Great Hall
11:15	11:30	Autonomous observing: The Astronomer's Last Stand	A. Allan
11:30	11:45	Vector Gradient Intersection Transform	H. Lorch
11:45	12:00	Optimal Extraction of Echelle Spectra	N. Piskunov
12:00	12:15	LSB Galaxies Detection Using Markovian Segmentation on Astronomical Images	M. Louys
		Session 6b: Data Archiving and Preservation	Small Hall
11:15	11:30	Automated Data Tagging in the HLA	N. Gaffney
11:30	11:45	The JCMT Science Archive and the Virtual Observatory	S. Gaudet
11:45	12:00	Evaluation of Lossless Compression Methods for Astronomical Image Data	C. Gruenler
12:00	12:15	ELT Science Case Evaluation Using An HPC Portal	P. Linde
12:15	13:30	**Lunch, Poster & Demo Viewing**	
		Session 7: Image Processing and Data Visualisation I	Great Hall
13:30	14:00	Astronomy + Medicine = Understanding	A. Goodman (invited)
14:00	14:15	3D Visualization and Detection of Outflows From Young Stars	M. Borkin
14:15	14:30	S2PLOT: A Straightforward Library for Advanced 3-dimensional Scientific Visualisation	D. Barnes
14:30	14:45	Accessing eSDO Solar Image Processing and Visualisation through AstroGrid	E. Auden
14:45	15:45	**Coffee Break, Poster & Demo Viewing**	
		Focus Demo 2	Small Hall
15:00	15:30	VirGO: A Visual Brower for the ESO Science Archive Facility	F. Chereau
		Session 8: Image Processing and Data Visualisation II	Great Hall
15:45	16:15	Accuracy and Aesthetics: Scientific Visualization Using Hollywood Tools	F. Summers (invited)
16:15	16:30	VOExplorer: Visualising Data Discovery in the Virtual Observatory	J. Tedds
16:30	16:45	Building Rich Internet Applications in Astronomy	D. Magee
		BoF 2.1	Great Hall
16:45	18:15	Data Mining for Large Scale Astronomical Datasets: Challenges, Milestones and Solutions	S. McConnell
		BoF 2.2	Small Hall
16:45	18:15	IRAF Users and Developers	M. Fitzpatrick
20:00	23:00	**Conference Dinner**	Great Hall

		Wednesday, 26 September	
		Session 9: Data Mining I	Great Hall
08:30	09:00	Large-scale Pulsar Survey at Arecibo Using ALFA: Data Mining and Management	J. Cordes (invited)
09:00	09:15	Probabilistic Cross-identification of Astronomical Sources	T. Budavari
09:15	09:30	A Method for Exploiting Domain Information in Parameter Estimation	C. Bailer-Jones
09:30	09:45	VIM: A Tool to Explore Your Sources	R. Williams
09:45	10:00	Needles in a Haystack: Faceted Browsing and the Virtual Observatory	D. Burke
10:00	10:15	PaperScope: Graphically Exploring the ADS	M. Holliman
10:15	11:30	**Coffee Break, Poster & Demo Viewing**	
		Session 10: Miscellaneous	Great Hall
11:30	11:45	The IAU 2000/2006 Changes to Celestial Reference Systems: A Bluffer's Guide	P. Wallace
11:45	12:00	Scientific Data Analysis through Web Services in a Scientific Grid	C. Gabriel
12:00	12:15	Software Modelling of IFU Spectrometers	N. Lorente
12:15	12:30	ECSS in the eXtreme	W. O'Mullane
12:30	14:00	**Lunch, Poster & Demo Viewing**	
		Focus Demo 3	Great Hall
14:00	14:30	PaperScope in Use	M. Holliman
		Session 11: Data Mining II	Great Hall
14:30	15:00	Morphological Description of the Large Scale Cosmic Structures	V. Martinez (invited)
15:00	15:15	Data Mining Large Surveys: The IPHAS Early Data Release	E. Gonzalez-Solares
15:15	15:30	Robust Machine Learning Applied to Terascale Astronomical Datasets	N. Ball
15:30	15:45	20 Spatial Queries for an Astronomer's Bench (mark)	M. Nieto-Santisteban
15:45	16:00	Finding Outliers in Multivariate Data with Measurement Errors	S. Raychaudhury
16:00	16:15	Closing Remarks	
16:15	17:00	**Poster/Demo Break Down**	

Dear All,

It is a pleasure to welcome you all to the 17th annual Astronomical Data Analysis Software & Systems conference. We hope that you will find the conference both interesting and enjoyable. We would also like to take this opportunity to welcome you to the city of London, which is one of the biggest and most exciting cities in the world. Although the conference agenda will be very ambitious this year we hope that you will be able to find time to enjoy some the historical and cultural attractions London has to offer.

Organising a conference as big as this one takes not only a great deal of time and effort, but also a lot of money. The expense of running this ADASS would have been prohibitive were it not for the generous support of the organisations listed below, to whom we are very grateful:

European Southern Observatory
European Space Agency
Infrared Processing & Analysis Center
National Optical Astronomy Observatory
National Radio Astronomy Observatory
Smithsonian Astrophysical Observatory
Science & Technology Facilities Council
Space Telescope Science Institute

The members of the Local Organising Committee are:

Bob Argyle	Peter Bunclark
Dafydd Evans	Eduardo Gonzalez-Solares
Simon Hodgkin	Mike Irwin
Elinor Jenkins	Jim Lewis
Marco Riello	

All of these people are identifiable by the red printing on their name tags and will be available at all times during the meeting to assist with any queries you may have.

Finally we'd like to thank all the members of the Program Organising Committee for all their hard work in preparing this programme for ADASS XVII:

Tim Cornwell (ATNF)	Daniel Durand (CADC)
Daniel Egret (CDS)	Allen Farris (NRAO)
Carlos Gabriel (ESA-ESAC)	Tom Handley (IPAC)
Richard Hook (ST-ECF)	Athol Kemball (NCSA)
Jim Lewis (Cambridge)	Glenn Miller (STScI)
Koh-Ichiro Morita (NAOJ)	François Ochsenbein (CDS)
Michele Peron (ESO)	Arnold Rots (SAO)
Betty Stobie (Arizona)	Christian Veillet (CFHT)

Have a great conference!

Jim Lewis, Chair	Arnold Rots, Chair
Local Organising Committee, ADASS XVII	Program Organising Committee

Contents

1. Tutorials

T1 3D Visualization in Astronomy

Jens Kauffmann (Center for Astrophysics & Initiative in Innovative Computing, Harvard University), Michelle Borkin (Initiative in Innovative Computing, Harvard University), Michael Halle (Initiative in Innovative Computing & Surgical Planning Laboratory, Harvard University), Doug Alan (Initiative in Innovative Computing & Surgical Planning Laboratory, Harvard University), Nick Holliman (University of Durham), Ugo Becciani (INAF - Catania Astrophysical Observatory), Claudio Gheller (CINECA)

The complexity and data size of multi-dimensional datasets from astronomical observations and simulations is growing at an accelerating rate. Exploring these data sets, discovering new structures, and analyzing them is increasingly difficult for astronomers and cosmologists using only traditional software programs based on two-dimensional image display. While slice by slice viewing of datacubes will always be part of the astronomers computational toolkit, multi-dimensional data of complex or unknown structure is often more naturally explored using three-dimensional visualization tools. However, despite an growing need for 3D visualization software, only a small number of such tools are available to the astronomy community at this time. This tutorial will provide a foundation for understanding the opportunities that 3D data visualization offer to astronomy. Specifically, we will demonstrate examples of the use of 3D visualization in astronomy, introduce the computer graphics and visualization concepts relevant to astronomy visualization tools, and outline the development details and capabilities of several 3D visualization software projects currently available. We will also demonstrate the potential value of astronomical data exploration using stereoscopic displays. Ample time will be reserved to discuss the communitys requirements for 3D visualization in astronomy. We hope that this tutorial contributes to the creation of a community of people interested in developing and using new methods for exploring multi-dimensional data sets.

T2 An Introduction to Data Mining in Astronomy

Sabine McConnell (Department of Computer Science, Trent University)

Over the past decade, data mining has gained a solid foothold in a variety of research areas. Data mining approaches attempt to extract novel and potentially useful information from large datasets in a semi-automated manner, and combines traditional analysis methods from the field of statistics with algorithms from machine learning, databases technology and visualization techniques.

Data-mining approaches are divided into two main categories: predictive and descriptive. Predictive, or supervised, data-mining techniques build models to forecast the value of unknown or future attribute values based on known feature values. Depending on the type of the target, or class attribute, predictive approaches are divided into regression (continuous target attribute) or classification (discrete target attribute) tasks. In contrast, descriptive approaches attempt to discover underlying structures in the data without prior knowledge of the type or value of the target attribute. Other applications of data-mining techniques include visualization of data, association rule mining, and outlier detection. To date, data-mining techniques have been successfully applied to a large range of astronomical problems such as the separation of stars and galaxies, classification of planetary nebulae, galaxies and stars, antimatter search in cosmic rays, detection of expanding HI shells and selection of quasar candidates. However, the characteristics of astronomical data such as the noise associated with the collection process, the existence of multiple measurements of the same object, or the size of the datasets, complicate the data-mining process and warrant additional care when applying data-mining techniques in this domain. The content of the tutorial will be split into both a theoretical and practical component.

Theoretical component: introduction and overview.

- introduction to the basics of data mining
- introduction to data-mining goals: classification, regression, clustering, and outlier detection in combination with an overview of existing work in astronomy
- overview of a selection of data-mining techniques and their applicability to astronomical data
- pitfalls and dangers with a focus on the characteristics of astronomical data
- an overview of data-mining software (both open source and proprietary)

Practical component

- a hands-on introduction to the functionality of the data-mining software
- participants will engage in a short investigation of astronomical data (drawn from a number of simulations and observations and supplied by me), which will illustrate the concepts introduced in the theoretical component.
- short discussion

2. Oral Presentations

1. Data Preservation

O1.1 Data Preservation and the Virtual Observatory (Invited)

Robert Mann (Institute for Astronomy, University of Edinburgh)

The Virtual Observatory (VO) promises to provide astronomers with the ability to re-use archival data with an ease, and on a scale, impossible before. This gives issues relating to the preservation (and, more generally, curation) of astronomical data a greater prominence. In this talk I shall review some of these issues, from a perspective informed both by personal experience as a data curator, and through interaction with data curators in other domains. Astronomers can, in general, feel proud at the way that we structure, describe, store and publish our data, but we can still learn from the experiences of other disciplines and should contribute actively to the multidisciplinary data curation community which is currently taking shape worldwide.

O1.2 Trusted Data Repositories (Invited)

David Giaretta (STFC)

Data is valuable, expensive to create, and may be impossible to re-create, so who can be trusted to look after it in the long term? This is a question which applies to all the types of digital data on which most astronomical research, and much of the rest of civilisation, depends.

This talk will outline the work which has been, and continues to be, carried out to provide an answer to the question of how to judge whether any given data repository is up to the task and deserves to be funded.

The OAIS Reference Model (ISO 14721) forms the basis of most serious work on digital preservation and the aim of the work described here is to build on OAIS to create an international standard on which an accreditation and certification process can be based.

The talk will touch on some of the fundamental ideas about preservation of digital objects and on ways to detect preservation snakeoil salesmen.

O1.3 Long-Term Preservation of Astronomical Research Results

Robert Hanisch (Space Telescope Science Institute), Sayeed Choudhury (The Johns Hopkins University), Ethan Vishniac (McMaster University), Kevin Marvel (American Astronomical Society), Alex Szalay (The Johns Hopkins University)

Astronomers are producing and analyzing data at ever more prodigious rates. NASA's Great Observatories, ground-based national observatories, and major survey projects have archive and data distribution systems in place to manage their standard data products, and these are now interlinked through the protocols and metadata standards agreed upon in the Virtual Observatory. However, the digital data associated with peer-reviewed publications is only rarely archived. Most often, astronomers publish graphical representations of their data but not the data themselves. Other astronomers cannot readily inspect the data to either confirm the interpretation presented in a paper or extend the analysis. Highly processed data sets reside on departmental servers and the personal computers of astronomers, and may or may not be available a few years hence. Descriptive metadata, adequate at best for archival collections and associated data discovery services, is often inaccurate or lost once data moves out of pipeline systems into scientists' hand-crafted software. Those data that are preserved, e.g., in systems like ADIL, Vizier, and NED, are typically collected independently from the usual manuscript submission and editing process. We are investigating ways to preserve and curate the digital data associated with peer-reviewed journals in astronomy and to integrate data collection into the editorial process. The technology and standards of the VO provide one component of the necessary technology. A variety of underlying systems can be used to physically host a data repository, and indeed this repository need not be centralized. The repository, however, must be managed and data must be documented through high quality, curated metadata. This curation effort can only partially be automated. Multiple access portals can be available: the original journal, the host data center, the Virtual Observatory, or any number of topically-oriented data services utilizing VO-aware access mechanisms.

O1.4 Building a Framework for Data Preservation of Large-Scale Astronomical Data

Jeffrey Kantor (LSST Corporation), Ray Plante (University of Illinois National Center for Supercomputing Applications), Kian-Tat Lim (Stanford Linear Accelerator Center), Jeffrey Bartels (Cirrus Enterprises)

The Large Synoptic Survey Telescope will archive petabytes of images and catalog billions of astronomical objects and trillions of sources, all of which will be stored and preserved for decades. As the image data is processed into sources, and the sources associated into astronomical objects by the LSST pipelines, the results must be persisted in a variety of formats and into file and database management storage systems. There are challenges in providing a robust, transactional, high-speed interface that encapsulates the underlying formatting and storage system architecture, provides uniform handling for metadata and provenance, and allows for a variety of usage contexts including development, testing, and operations. In this paper we summarize these challenges and describe the Application Programming Interface to the LSST Middleware Layer that implements the preservation capabilities.

2. Footprints and Mosaics

O2.1 Making the Sky Searchable: Automated Astrometry (Invited)

David Hogg (New York University)

For the purposes of (a) restoring meta-data of badly archived astronomical imaging data, (b) adding meta-data to amateur data and thereby bringing them into the professional domain, (c) relieving hardware and software projects from demanding astrometric requirements, and (d) making life better for observers, we have created a web service that automatically calibrates astronomical image coordinate systems. This system makes use **only** of the information in the image pixels, and needs no prior information about image pointing, rotation, or plate scale. It has a high success rate on real data and delivers essentially no false positives. I will demo the system, describe how it works, and summarize future plans for implementation, enhancement, and scientific discovery.

O2.2 Automated Image Registration for the Future (Invited)

Warren Hack (Space Telescope Science Institute)

A primary problem facing all surveys or archives of astronomical images remains the automated registration of the images. Images often have pointing errors not accounted for in their headers or metadata, errors which need to be removed in order to successfully combine them into a single, deeper, more scientifically valuable product. The primary techniques rely on either matching catalogs of positions or performing cross-correlation on images. Each of these techniques can only be applied successfully to limited sets of astronomical data. This talk will review the primary techniques currently used for image registration and identify their most obvious limitations for use in automated registration. A new algorithm merging the best of these techniques with a proven technique developed outside of astronomy will be explored as an example of a new paradigm for solving the problem of automated and robust image registration.

3. HEP Computing

O3.1 Data Acquisition in High-Energy Physics (Invited)

Johannes Gutleber (CERN), Luciano Orsini (CERN)

High-energy physics studies the laws that regulate the universe at subatomic scale. For that purpose, subatomic particles are accelerated and brought to collision at high energies, today reaching tens of TeV. The interactions, termed 'events' occur in advanced machines at tens of MHz rates. Energy is reconverted into matter and new particles, unseen under ordinary conditions are created. Multiple detectors with millions of channels track the newly created particles by application of diverse means (calorimetry, proportional wire-chambers, solid-state detectors to name but a few). Data rates and volumes depend on the type of particles collided. In proton-proton collisions at the Large Hadron Collider at CERN data volumes per event are in the order of 1 Megabyte. Metaphorically spoken, detectors take a photo of each event. Unlike an optical camera, they work with multiple kinds of lenses and films and show therefore only jigsaw like parts of the whole. The data acquisition systems tasks are to combine the parts to complete images and to present them to on-line processing subsystems that select those events, which are interesting for further physics analysis. Events that do not pass the selection are discarded.

The challenges in high-energy physics data acquisition are threefold:

1) At technical level we are confronted with a large embedded, distributed system that contains real-time paths. Since the operational phase is usually reached through consecutive partial installations and the system is frequently upgraded to match the physicists' demand for higher data volumes, the system must be scalable by architecture and design. Adding new parts must yield higher performance of the whole system. To allow for flexibility in gradual installation and upgrades of the system, dependency on custom parts are to be kept small and COTS equipment is leveraged. The high throughput requirements stem from the 'event-building' process, the task to combine data fragments to a complete physics event. Industry pursues different goals and application scenarios and therefore COTS switching systems do not fully satisfy our domain. Our software infrastructures must therefore compensate for the shortcomings in commercial networking hardware. The levers are buffer-loaning, zero copy operation and traffic shaping for communication and work-queues for processing.

2) At operational level we need to monitor and control large distributed systems. The task is split into two parts: A detector control system is in charge of operating the installation. It is usually implemented using commercial SCADA tools and techniques. It monitors and controls the environment and controls all resources that the detector needs to operate. These include but are not limited to cooling and cryogenics, high and low voltage, calibration of the detectors, thermal and magnetic shielding, managing the interface to the particle accelerator. The data acquisition is configured, monitored and controlled by a separate system. Here, we do not only face the need to operate a single cluster computing system, but a system of systems. The total number of processing devices that constitute a current data acquisition system is in the order of tens of thousands of computers. It is distinct from commercial SCADA systems by the much higher control and monitoring data volumes and rates as well as the non-uniform interfaces. In fact, monitoring a data acquisition system requires a data acquisition system on its own. The separate clusters run applications, which need to be launched, configured, monitored and synchronized. For a steering of this kind we leverage a combination Web and peer-to-peer technologies. The Web-peers are discoverable data acquisition applications running on each computing node with embedded Web-service protocol engines. This approach let us tap into a large set of tools and techniques that are already available to ease the coordination of the distributed applications, to provide overview and drill down monitoring facilities and last but not least to secure access. We experienced that the successful error detection is one of the most critical issues and determines success or failure of a system.

3) At organizational level, orchestrating the developments and integrating the numerous subsystems are the biggest challenges. Historically, each detector is viewed as an autonomous system, developed and tested by

a separate high-energy physics institute or university physics department. Such a worldwide collaboration differs substantially from industry projects in that project management acts as a steering body rather then a control and delegation organ. We ensured success by providing all groups with the same software infrastructure. Then we tutored them the same concept of building their subsystem and using mechanisms that allow integrating loosely coupled subsystems. At low levels we achieve this through minimally standardized high-speed serial data links and easy to use but highly efficient, standardized message passing systems used in a common processing environment. At configuration, monitoring and control level we foster a Web Service architecture and workflow-oriented techniques based on XML for data exchange. Configuration management and deployment are carried out centrally. Monitoring and control can, however, be performed from any place in the world.

O3.2 Data Analysis in High Energy Physics, Weird or Wonderful? (Invited)

Richard Mount (Stanford Linear Accelerator Center)

For decades, other sciences viewed the scale and nature of high energy physics data analysis as just too weird to be widely relevant. Science, in general, is becoming increasingly data-challenged, spurring increased efforts to understand the commonalities and the differences between sciences. As SLAC broadens its science program beyond HEP to include data analysis in Astronomy and in Photon Sciences, we are finding these commonalities and we are improving our understanding of the differences. I will outline the fundamental physical drivers of the scale and nature of HEP data analysis. I will outline how analysis is done, and the issues created by a changing balance between computational performance and the various aspects of storage performance. Finally, I will give my perspective of where the challenges faced by HEP are likely to be common to Astronomy and other sciences.

O3.3 GLAST LAT Computing: A Fusion of HEP and Astrophysics

Richard Dubois (Stanford Linear Accelerator Center)

The Large Area Telescope is a particle physics-style instrument being launched into space on the GLAST mission in late 2007 to measure gamma rays in the 0.02–300 GeV energy range. Event interpretation follows classic HEP techniques to determine the photon direction and energy from tracks left in the Si strip tracker and energy deposit in the CsI calorimeter. Instrument design and algorithm development have been facilitated by large scale full event simulations. Significant amounts of C++ code have been adopted from HEP, including GEANT4, Root and Gaudi. Once events have been reconstructed and tagged as signal or background, photon analysis, largely based on model fitting due to limited photon statistics, begins. The suite of tools is all FITS/FTOOLS based for public distribution by NASA's HEASARC, with source finding and likelihood fitting taking center stage. Routine data processing requires 100+ CPUs to turn around a downlink of 3 hours of orbit data in about one hour. We have designed a processing pipeline system that allows independent operation of multiple tasks, such as prompt processing, data monitoring, reprocessing and simulations. Some 400 cores will be devoted to processing and simulations at SLAC. The batch jobs are submitted centrally to multiple batch farms available to GLAST, providing an additional 400–500 cores for simulations. Data Challenges, in which a realistic sky is fully simulated for useful observation times have been used as end to end tests of the software system, from sky generation, automated bulk processing through to science analysis. True sky content was withheld from the scientists, encouraging a realistic first look at the sky and development of analysis algorithms. The collaboration is about evenly split between HEP- and astro-physicists.

4. Web Services and the Virtual Observatory

O4a.1 The NOAO NVO Portal and the Web 2.0

Christopher Miller (National Optical Astronomy Observatory), Exequiel Fuentes (National Optical Astronomy Observatory), David Gasson (National Optical Astronomy Observatory)

Web developers are beginning to build applications that are as rich as local PC-based applications. These new applications often use Asyncronous Javascript and XML (Ajax), integrate external services, have lightweight development models, and quick turn-around periods. Typically, they are based on a unique source of data. The NOAO NVO Portal is just one example of an application falling under the Web 2.0 pattern in astronomy. We discuss the concept of the Web 2.0 with respect to the planning, development, and deployment of the NOAO NVO Portal, including its advantages and pitfalls.

O4a.2 A Critical Point in the VO

David Schade (Canadian Astronomy Data Centre), Severin Gaudet (Canadian Astronomy Data Centre)

The Virtual Observatory needs to be transformed from a compelling idea in the astronomy-information technology community into a real set of services that is used widely by the science community. After 5 years of effort we are at a critical point for VO. We need to demonstrate that we can attract substantial science usage if we are to continue to enjoy community support and attract continued funding.

Two things are needed for the VO to become important to astronomers. We need standards upon which to build infrastructure and we need a diverse and well-designed set of data collections and services that are built using these standards.

The IVOA is the key organization for creating an operational VO. The IVOA has embraced the role of managing the process of developing standards for VO. Those working on these standards deserve respect and admiration for their ground-breaking work over the past 5 years. But the process has been slow. That problem has been recognized and steps have been taken to improve the process.

The IVOA has not yet taken steps to vigorously encourage the implementation of the VO standards. This role is clearly part of the IVOA mandate to facilitate the collaboration necessary to make an operational VO a reality. The IVOA must be strongly encouraged to take on a coordinating role and I'll make some suggestions on what needs to be done.

Individually, those of us in data centres, those in projects producing major data collections, those individuals who have a stewardship role for major data collections, in other words those of us providing data, processing and/or workflow services, we must commit to quickly implementing these services based on VO standards . In this way we can succeed in attracting a high-level of usage by scientists.

O4a.3 Cloudspace: Virtual Environments in the VO

Matthew Graham (California Institute of Technology), Roy Williams (California Institute of Technology)

The grid community is moving towards providing on-demand computing in the form of virtual workspaces – abstracted execution environments that are dynamically made available to authorized clients. In part this is a reaction to market forces represented by such commercial initiatives as Amazon EC2 and in part a solution to hot service deployment. One danger, though, is that a multiplicity of implementations will lead to a lack of interoperability. Such a concern in the VO regarding distributed data storage led to the development of VOSpace, a lightweight abstraction layer that sits on top of existing storage solutions such as SRB. In this paper, we introduce Cloudspace, a resource-oriented extension of VOSpace, that incorporates UWS, the VO pattern for managing asynchronous services, to form a natural habitat for virtual environments in the VO. A notable feature of the Cloudspace concept is that distributed data and computing can be managed seamlessly through a single mechanism thus making the astronomer's life easier as we move into a new era of sophisticated computational astronomy.

O4a.4 Workflow in Astronomy : the VO France Workflow Working Group experience

Andre Schaaff (Observatoire de Strasbourg), Franck Le Petit (Observatoire de Paris), Philippe Prugniel (Observatoire de Lyon), Eric Slezak (Observatoire de la Cote d'Azur), Christian Surace (Laboratoire d'Astrophysique de Marseille)

The French Action Spécifique Observatoires Virtuels has created the Workflow Working Group in 2005. Its aim is to explore the use of the Workflow paradigm in the astronomical domain. The first consensus was the definition of a Workflow as a sequence of tasks realized in a controlled context (at various levels: intelligence in the choice of the algorithms, flow control, etc.), based on use cases studies, in an architecture which takes into account VO standards. The current roadmap is to provide scientific use cases in several domains (image, spectrum, simulation, data mining, etc.) and to improve them with VO (and other) existing tools. Another important point is to develop collaborations with the IT community (links to EGEE, ...). Use cases are useful to compare the pertinence of the possible workflow models and to understand how to implement it as efficiently as possible with the existing tools (ex. : AstroGrid, AÏDA, WebCom-G, etc.). The execution (local machine, cluster, grid) through this kind of tools and the use of VO functionalities (Web Services, GRID, VOSpace, etc.) becomes almost transparent. We are now focusing on the following topics : extension of the use case definition to other domains, definition of the common parts of use cases (spectrum, image, etc.), workflow langage interoperability, creation of a library of modules.

All informations concerning the working group are available on the OV France TWiki at : `http://www.france-ov.org/twiki/bin/view/GROUPEStravail/Workflow`

5. Image Processing and Mosaics

O4b.1 The NOAO Pipeline Applications

Francisco Valdes (NOAO), Robert Swaters (University of Maryland), Derec Scott (National Optical Astronomy Observatory), Mark Dickinson (National Optical Astronomy Observatory)

We previously presented the NOAO High Performance Pipeline System (NHPPS), which provides a general framework for parallel and distributed pipeline applications, and a first application for the twin NOAO CCD Mosaic Imagers (Mosaic). Since then we have expanded on the system and pipeline, and developed additional applications for the recently commissioned NOAO Extremely Wide-Field Infrared Imager (NEWFIRM). In this presentation we briefly describe our current and planned suite of pipeline applications, the multiple application support added to the NHPPS, and some performance details for the completed Mosaic Pipeline which is now in operational use. The NEWFIRM Pipeline applications are described in more detail in the accompanying presentation.

O4b.2 The MONTAGE Service: Custom Mosaics on Demand

Bruce Berriman (IRSA / IPAC / Caltech), Mih-seh Kong (IRSA / IPAC / Caltech), John Good (IRSA / IPAC / Caltech), Anastasia Laity (IRSA / IPAC / Caltech)

The Montage software suite (`http://montage.ipac.caltech.edu`) is a powerful and completely general engine for reprojecting, background matching, and mosaicking any astronomical image data. It is used world-wide in a variety of environments, such as product generation by the Spitzer Legacy teams, astronomical research, and in E/PO work. The processing algorithms support all common World Coordinate System (WCS) projections and have been shown to be both astrometrically accurate and flux conserving. The background 'matching' algorithm rectifies the background level in the images to a common level across the mosaic.

The Infrared Science Archive (IRSA), part of the Infrared Processing and Analysis Center (IPAC) at Caltech, has now wrapped the Montage software as a CGI service and provided a compute and request management infrastructure capable of producing approximately 2 TBytes / day of custom image mosaic output (e.g. from 2MASS and SDSS data). The system is a dedicated, highly scaleable yet inexpensive engine ($40 K in processors and staging storage) that overcomes the latency inherenty in the Teragrid at mosaic scales of 25 deg2 or less. It is a pathfinder for investigating cheap but robust solutions for the next generation of astronomical surveys, such as the LSST. Besides the basic Montage engine, this service makes use of a 16-node LINUX cluster (dual processor, dual core) and ROME (Request Object Management Environment), a unique EJB-based software package developed by the National Virtual Observatory (NVO) to manage user requests, queue processing, load balance between users, and deal with various flavors of monitoring / notification. The Montage service will be extended in future to handle any user-defined data collections, including private data uploads.

O4b.3 Distributed Processing of Future Radio Astronomical Observations

Ger van Diepen (ASTRON/ATNF)

Future radio telescopes like LOFAR, MIRANdA, and MeerKAT will produce large amounts of data. For instance, a 12 hour HI line observation with MIRANdA results in a data set of several tens of terabytes. Processing these amounts of data is an enormous challenge, both with respect to IO and computations.

This presentation discusses how the processing can be done in a highly distributed way. A first version of a Master-Worker framework has been developed making it easily possible to execute the required tasks in a distributed way without the need of pumping those terabytes of data around the network. The key motto is 'bring the processes to the data, NOT the data to the processes'. Only when needed some highly condensed data is exchanged between the processes. The framework is designed to utilize mirroring of data for purposes of fault tolerancy and faster processing. It is suitable for deployment on a variety of systems ranging from a commodity Linux cluster to a supercomputer like the BG/L or Cray XT3.

O4b.4 LOFAR Self-Calibration Using a Blackboard Software Architecture

Marcel Loose (ASTRON)

One of the major challenges for the self-calibration of the new LOFAR radio telescope is to handle the sheer amount of observational data. An average observation consists of several tens of terabytes of data. Fortunately, many operations can be done in parallel on only part of the data. So, one way to take up this challenge is to employ a large cluster of computers and to distribute both data and computing power.

This presentation focuses on the architectural design of the LOFAR self-calibration system, which is loosely based on the Blackboard architectural pattern. Key design consideration was to provide maximum scalability by complete separation of the global controller issuing sequences of commands on the one side; and the local controllers controlling the so-called 'kernels' that execute the commands on the other side. In between, resides a database system that acts as a shared memory for the global and local controllers by storing the commands and the results.

6. Algorithms and Image Processing I

O5.1 PLANCK/HFI Data Analysis (Invited)

Ken Ganga (Laboratoire APC/CNRS)

The HFI is one of two instruments to be launched on Planck, a satellite designed to study the Cosmic Microwave Background Radiation. The launch is scheduled for late 2008. I will describe CMB data analysis, with specific emphasis on preparations for the Planck/HFI data reduction, including expected challenges and solutions. I will also mention some non-CMB analysis issues which Planck/HFI will face.

O5.2 Image Processing Application for Cognition (IPAC) -Traditional and Emerging Topics in Image Processing (Invited)

Meyer Pesenson (California Institute Of Technology), William Roby (California Institute Of Technology), George Helou (California Institute Of Technology), Loi Ly (California Institute Of Technology), Bruce McCollum (California Institute Of Technology), Xiuqin Wu (California Institute Of Technology)

During the last fifteen years the image processing (IP) community has made a substantial progress in developing powerful methods for IP and computer vision. Adapting these advances for astronomy, and especially design and implementation of an advanced image processing system, which would utilize these continuing achievements, remains, however, a major challenge. A keystone element of such system should be a computational framework with visualization, which unifies the wide range of methods and algorithms, and has the capability of extensibility.

Using the extensive visualization tools that we developed for both Spitzer Spot and Leopard, we are exploring a mission independent visualization and processing application. The visualization component contains many common features plus the ability to combine these images in new a unique ways, access to most astronomy data archives, and ability to read very large fits files with small memory footprint. The interactive processing tool allows the users to set up simple post-mosaic processing pipelines and interactively monitor and visualize each step of the stream.

Simply implementing some of the new methods of IP, however, is not sufficient. Image processing is ultimately concerned with making better images, but the term 'better' is rarely defined. In order to be able to evaluate performance of the algorithms, adequate metrics for quality assessment (QA) have to be established. Thus supporting interactive processing of rapidly increasing astronomical data sets demands a new approach based on integration of image processing, analysis and image Quality Assessment (iQA). A first prototype of such synergetic, platform independent, application framework was reported at ADASS XVI and its augmented version is presented here. This ongoing work implements recent developments in the field of image processing as well as original algorithms based on nonlinear partial differential equations (PDEs). These algorithms applied to multi-scale astronomical images, allow to increase signal to noise ratio, preserve point sources and, at the same time, extended diffuse structures.

In this presentation we will address astronomical applications of traditional topics of IP (image enhancement, image segmentation) as well as emerging new topics (metrics for automated iQA consistent with subjective human evaluation, feature extraction), which have potential for shaping future developments in the field.

A demonstration of the Image Application Framework will be given at a BoF session.

O5.3 LSST and the Dark Sector: Image Processing Challenges (Invited)

J. Anthony Tyson (University of California, Davis)

The Large Synoptic Survey Telescope and its 3.2 gigapixel camera will cover the sky every few nights. The 30TB of raw data every night will be processed fast in order to detect transient objects as well as for automated quality control. There are other challenges which will require continued algorithm development: LSST will probe the physics of the 'dark sector' [dark matter and dark energy] in multiple ways using deep images of several billion galaxies. It is the first system built specifically to minimise systematic errors in gravitational weak lensing. I will review weak lensing image processing and algorithms, and simulations of the LSST performance.

O5.4 Organizing the Extremely Large LSST Database for Real-Time Astronomical Processing

Jacek Becla (Stanford Linear Accelerator Center), Kian-Tat Lim (Stanford Linear Accelerator Center), Serge Monkewitz (California Institute Of Technology), Maria Nieto-Santisteban (Johns Hopkins University), Ani Thakar (Johns Hopkins University)

The Large Synoptic Survey Telescope will catalog billions of astronomical objects and trillions of sources, all of which will be stored and managed by a database management system. One of the main challenges is real-time alert generation. To generate alerts, up to 100K new difference detections have to be cross-correlated with the huge historical catalogs, and then further processed to prune false alerts. This paper explains the challenges, the implementation of the LSST Association Pipeline and the database organization strategies we are planning to use to meet the real-time requirements, including data partitioning, parallelization, and pre-loading.

7. Algorithms and Image Processing II

O6a.1 Autonomous Observing: The Astronomer's Last Stand

Alasdair Allan (University of Exeter), Iain Steele (Liverpool JMU, Liverpool, UK), Robert White (Los Alamos National Laboratory, New Mexico, USA), Frederic Hessman (Georg-August-Universität, Göttingen, Germany)

In the last few years the ubiquitous availability of high bandwidth networks has changed the way both robotic and non-robotic telescopes operate, with single isolated telescopes being integrated into expanding smart telescope networks that can span continents and respond to transient events in seconds. We discuss work by the eSTAR project which demonstrates a fully closed loop autonomous system for the follow up of possible micro-lensing anomalies. Here not only are the initial micro-lensing detections followed up in real time, but ongoing events are prioritised and continually monitored, with the returned data being analysed in real time. If the 'smart software' running the observing campaign detects a planet-like anomaly, further follow-up will be scheduled autonomously and other telescopes and telescope networks alerted to the possible planetary detection. We further discuss the implications of this, and other projects, on the growing meta-network of 'HTN'::`http://www.telescope-networks.org/` enabled sites, and discuss the protocol and transport standards agreed by the 'HTN'::`http://www.telescope-networks.org/`, which deals with the complex issue of how to optimally schedule observations on geographically distributed resources, can be used to build such autonomous observing systems.

O6a.2 Vector Gradient Intersection Transform

Henning Lorch (European Southern Observatory)

This paper presents a new algorithm for the detection of circular objects in images. A new transform, the Vector Gradient Intersection Transform, is used to determine the centers of circular objects. It is based on the principle that imaginary lines, defined by the gradient vectors at a circle's edge, all intersect in its center. This easily allows one to determine the location of a circle. The input space and the transformed space have the same number of dimensions, which is less than the one produced by a Hough transform. It also works on partial circles. The complexity of the implemented algorithm is of the order of O(N*sqrt(N)). The radius of a circle can be easily determined in a final step.

O6a.3 Optimal Extraction of Echelle Spectra

Nikolai Piskunov (Uppsala University)

We present a novel Slit Function Decomposition algorithm for optimal extraction of echelle spectra addressing the issues of unknown and variable slit illumination (e.g. in case of image slicer or spectropolarimetry) and variable tilt of the dispersion direction and slit orientation in respect to the detector columns/rows. This algorithm maximizes the recovered science signal while minimizing the contribution of the noise with no a priori assumptions about the PSF. The reconstruction is formulated as an inverse problem solved by iterations and it is robust against most of the systematic problems including cosmic rays and cosmetic defects. The algorithm turned out to be very flexible and was sucessfully used for data reduction for nearly 20 echelle astronomical spectrometers.

O6a.4 LSB Galaxies Detection Using Markovian Segmentation on Astronomical Images

Mireille Louys (LSIIT , Université Louis Pasteur, Strasbourg), Benjamin Perret (LSIIT, Université Louis Pasteur, Strasbourg), Bernd Vollmer (Centre de données astronomiques de Strasbourg), François Bonnarel (Centre de données astronomiques de Strasbourg), Sebastien Lefèvre (LSIIT, Université Louis Pasteur, Strasbourg), Christophe Collet (LSIIT, Université Louis Pasteur, Strasbourg)

We have designed a new technique for the detection of Low Surface Brightness galaxies based on a new algorithm for local background/source separation using Markovian analysis. This method helps to estimate smooth local variations of the background and therefore allow for determining source candidates even very faint as LSB galaxies. For each source an average density profile is computed, the shape of which can help to sort out stars and bright objects. A list of LSB candidates is provided, for which position, profile and surface brightness are examined thoroughly. The results are very promising. This approach has been compared to the Sextractor source detection tool and to a previous original analysis by S. Sabatini and coll. on the same INT image dataset of the Virgo Cluster. Detection rate, source selection criteria and calculation loop improvements are discussed. Another approach based on morphological operators was also tested and is described here too. REFERENCES: S. Sabatini, J. Davies, R. Scaramella, R. Smith, M. Baes, S. M. Linder, S. Roberts,and V. Testa. The dwarf low surface brightness galaxy population of the Virgo cluster i. the faint-end-slope of the luminosity function. Mon.Not.Roy.Astron.Soc., 341 :981, 2003.

8. Data Archiving and Preservation

O6b.1 Automated Data Tagging in the HLA

Niall Gaffney (STScI), Warren Miller (STScI)

One of the more powerful and popular forms of data organization implemented in most popular information sharing web applications is data tagging. With a rich user base from which to gather and digest tags, many interesting and often unanticipated yet very useful associations are revealed. With regard to an existing information, the astronomical community has a rich pool of existing digitally stored and searchable data than any of the currently popular web community, such as You Tube or My Space, had when they started. In initial experiments with the search engine for the Hubble Legacy Archive, we have created a simple yet powerful scheme by which the information from a footprint service, the NED and SIMBAD catalog services, and the ADS abstracts and keywords can be used to initially tag data with standard keywords. By then ingesting this into a public ally available information search engine, such as Apache Lucene, one can create a simple and powerful data tag search engine and association system. By then augmenting this with user provided keys and usage pattern analysis, one can produce a powerful modern data mining system for any astronomical data warehouse.

O6b.2 The JCMT Science Archive and the Virtual Observatory

Séverin Gaudet (NRC/HIA/CADC), Patrick Dowler (NRC/HIA/CADC), Sharon Goliath (NRC/HIA/CADC), Russell Redman (NRC/HIA/CADC)

In 1994, the Canadian Astronomy Data Centre (CADC) began archiving and distributing public data from the James Clerk Maxwell telescope (JCMT), the first millimetre wavelength data archive available over the Internet. In 2004, in advance of the JCMT Legacy Survey (JLS), an ambitious programme that will provide the first large-scale survey of the sub-millimetre sky, the CADC was tasked with reviewing the archiving infrastructure in order to handle the high data volumes of the new instrumentation, to support both proprietary and pubic data access and to make the data available in the Virtual Observatory. In response to this the CADC proposed a complete re-tooling of the JCMT infrastructure, adopting VO-compatible data models and VO protocols at the core of the system, and anticipating the use of VO tools to support survey teams. Design and implementation began in the fall of 2005 and the first release occurred in March 2007. This talk will describe at a high level the design choices made, the challenges of engineering and transforming a telescope/instrument data model to a VO-compatible data model, and the effort to extend this system model to other archives at the CADC.

O6b.3 Evaluation of Lossless Compression Methods for Astronomical Image Data

Christian Gruenler (Staffordshire University/Univ. of Coop. Edu. Stuttgart), Hans Weghorn (BA-University of Cooperative Education Stuttgart), Claude C Chibelushi (Staffordshire University)

Virtual observatories and digital sky surveys produce huge amounts of astronomical image data. For reducing archival costs and transmission times that are caused by these tremendous storage requirements, different specific lossless compression methods have been newly developed or adopted from other scientific working fields for astronomical application purposes in the recent decades. Unfortunately, often users and generators of astronomical data do not yet profit from this development, despite of the efforts that have been put into the corresponding compaction algorithms. In practice, typically only general purpose methods from computer science are applied. One key cause for this effect may be that most of the proposed algorithms have only been evaluated and tested on a few sample images, and a comprehensive and reliable comparison of such methods is still missing. This work aims at providing such a comparison by using a set of standard images from an astronomy's standard imaging package. The evaluation does not only show, which of the existing methods do provide best compression ratio, it also unveils that efficient methods not necessarily have to be based on computational expensive transforms. It has been found that efficient methods are capable of reducing the size of 16-bit-per-pixel images typically by a factor of three, while the storage and time savings with current 32-bit-per-pixel images are even better, since they are ranging from typically a factor of 6 up to nearly eight.

O6b.4 ELT Science Case Evaluation Using An HPC Portal

Peter Linde (Lund Observatory), Jonas Lindemann (Lunarc, Center for Scientific and Technical Computing, Lund University)

Extremely Large Telescopes (ELTs) are now being seriously discussed and detailed designs are under way. In Lund explorative design studies have been made for more than a decade. ESO recently entered phase B for its European ELT (E-ELT) project. In parallel, the EU-sponsored Opticon organisation and ESO have made an effort to identify and investigate important ELT science cases. One of three key cases thus identified is the case of resolved stellar populations.

We have developed algorithms for the creation and analysis of ELT stellar fields, allowing detailed study of crowded stellar fields as well as clusters. A set of parameters control both the astrophysical aspects, such as age and metallity composition, observational properties, such as object distance, exposure time and PSF properties, and the technical aspects, such as sampling and noise properties.

The need to accurately model a detailed ELT PSF, together with the large amount of simulated field objects, lead to heavy demands on computing capacity. Our simulation system is implemented on the LUNARC supercomputing facility of Lund University, which recently installed a 1008 kernel cluster. In order to facilitate parallel computing for the science case analyst, we have developed a web-based portal to simplify access to the system. The web-based portal enables simulations to run on any grid-resources where the simulation application is installed.

The developed portal is based on the Lunarc Application Portal project, which provides a lightweight framework for implementing user interfaces for Grid-enabled applications. The main goal of the project is to enable easy implementation of web based user interfaces without extensive knowledge of grid-middleware. The portal framework is implemented using the Python-based WebWare for Python application server. The current version of the portal uses the ARC middleware for access to grid-resources, but will be replaced with a middleware neutral Job Submission Service. This service will enable the portal to submit jobs to additional grid resources using different grid middlewares, such as gLite and LCG and in addition also monitors and manages the entire job submission process.

9. Image Processing and Data Visualization I

O7.1 Astronomy + Medicine = Understanding (Invited)

Alyssa Goodman (CfA/IIC, Harvard University), Michelle Borkin (Initiative in Innovative Computing, Harvard University), Michael Halle (Initiative in Innovative Computing & Surgical Planning Laboratory, Harvard University), Nick Holliman (University of Durham), Jens Kauffmann (Center for Astrophysics & Initiative in Innovative Computing, Harvard University), Erik Rosolowsky (Center for Astrophysics, Harvard University)

Astronomy and medicine are two fields that rely heavily on imaging for insight. The 'Astonomical Medicine' project, based at Harvard's new 'Initiative in Innovative Computing,' seeks to combine the best advances in both medical and astronomical image display, manipulation, and analysis techniques, in order to create tools that are better for everyone. To date, our focus has been on three-dimensional data, such as the position-position-velocity data cubes typically produced by spectral-line observations. We have leveraged several existing medical imaging packages, all built upon ITK and VTK, in order to give astronomers easy access to views of their data as 3D surfaces and volumes.

The talk will focus both on the general overlap of the astronomical and medical challenges and solutions and on specific examples of successes to date. In one particularly noteworthy example, we have used the 3D Slicer package (see Note) to show that traditional 'segmentation' (a.k.a. 'clumpfinding') techniques used in the study of star formation need to be reconsidered, and that alternative 'tree-based' techniques may prove superior.

Note: The '3D Slicer' package, developed for surgical planning, has proven especially useful in our work, and a tutorial featuring 3D Slicer will be offered before the ADASS meeting. For more information, please see `http://astromed.iic.harvard.edu/`.

O7.2 3D Visualization and Detection of Outflows From Young Stars

Michelle Borkin (Initiative in Innovative Computing, Harvard University), Hector Arce (Department of Astrophysics, American Museum of Natural History), Alyssa Goodman (Initiative in Innovative Computing/Harvard-Smithsonian Center for Astrophysics), Michael Halle (Initiative in Innovative Computing/Brigham and Women's Hospital/Harvard Medical School)

We present a novel method for the identification of outflows from young stars using 3D isosurface models of molecular line data. Conventional methods for outflow detection, such as the inspection of individual spectra or integrated maps, are tedious and very inefficient when examining large data sets. As part of the Astronomical Medicine project at the Initiative in Innovative Computing (IIC) at Harvard University we utilized the 3D Slicer application to visualize ^{12}CO and ^{13}CO data cubes from the COMPLETE Survey. We generated 3D isosurface models in RA-DEC-velocity (p-p-v) space thus providing a visual representation of the gas kinematics in the cloud. These models were then inspected by eye for the rapid identification of outflows in the form of 'spikes' (since the velocity is measured along the line of sight) from the main distribution of gas. Using this method on the Perseus molecular cloud complex (8 square degrees), we were able to identify dozens of new outflows and extend the lengths of many previously identified outflows. We are also working on other visual and analytical methods, collaborating with our colleagues at the Harvard Medical School, for identifying outflows and other structures in star forming regions including the use of stereoscopic displays for data exploration and segmentation algorithms for feature identification.

O7.3 S2PLOT: A Straightforward Library for Advanced 3-dimensional Scientific Visualisation

David Barnes (Swinburne University of Technology), Christopher Fluke (Swinburne University of Technology)

S2PLOT is a user-oriented programming library for generating and exploring 3-dimensional (3d) scientific plots and diagrams. It provides a lightweight interface – based on the simple yet widely-used PGPLOT – to produce hardware-accelerated visualisations of point, line, image and volumetric data. S2PLOT provides C and FORTRAN interfaces, and supports monoscopic, stereoscopic and curved (eg. dome) display devices. PGPLOT-savvy astronomers can usually write their first S2PLOT program in less than ten minutes. In this paper, we introduce the latest S2PLOT version to the ADASS community and highlight major new additions to the library, including volume rendering and isosurfacing of astronomical data. We describe a simple extension that enables the embedding of large-area FITS images directly into S2PLOT programs using standard World Coordinate Systems, and we describe our plans for new S2PLOT features, and for Java and Python interfaces to S2PLOT.

O7.4 Accessing eSDO Solar Image Processing and Visualisation through AstroGrid

Elizabeth Auden (Mullard Space Science Laboratory), Silvia Dalla (University of Manchester)

The eSDO project is funded by the UK's Science and Technology Facilities Council (STFC) to integrate Solar Dynamics Observatory (SDO) data, algorithms, and visualization tools with the UK's Virtual Observatory project, AstroGrid. In preparation for the SDO launch in December 2008, the eSDO team has developed nine algorithms covering coronal behaviour, feature recognition, and global / local helioseismology; each of these algorithms has been deployed as an AstroGrid Common Execution Architecture (CEA) application so that they can be included in complex VO workflows. In addition, a data access prototype has been built to document the interface between the SDO Data Resource Management Systems (DRMS) and Storage Unit Management Systems (SUMS) deployed in the US and Europe with the AstroGrid DataSet Access (DSA) module and Simple Time Access Protocol (STAP) web service deployed in the UK. Finally, the PLASTIC-enabled 'STAP TV' online movie tool will demonstrated with a multi-instrument solar image set, accessed via the HelioScope service.

10. Image Processing and Data Visualisation II

O8.1 Accuracy and Aesthetics: Scientific Visualization Using Hollywood Tools (Invited)

Frank Summers (Space Telescope Science Institute)

Scientific visualization for the public has been made both harder and easier by the rapid development of computer graphics. Harder, because the general public is routinely wowed by the latest special effects laden Hollywood blockbuster. Easier, because of the numerous software tools developed to support this industry. I'll discuss the combination of commercial, free, and homegrown software that we use to create visualizations for the internet, television, documentaries, planetariums, and IMAX theaters. The desired goal is that the visualizations accurately reflect the astronomical data, yet have the aesthetic beauty to wow the public.

O8.2 VOExplorer: Visualising Data Discovery in the Virtual Observatory

Jonathan Tedds (University of Leicester), Noel Winstanley (University of Manchester), Andrew Lawrence (University of Edinburgh), Nicholas Walton (University of Cambridge), Elizabeth Auden (MSSL, University College London), Silvia Dalla (University of Manchester)

The range and complexity of data published using Virtual Observatory (VO) interfaces is rapidly increasing. These data are heterogeneous - and are published through various standard interfaces allowing access to images, catalogues, spectra, transient event data and so forth.

Providing access to these data is a success of the Virtual Observatory movement, where effective use of newly emerging publishing standards as provided by the International Virtual Observatory Alliance (www.ivoa.net) has been made by the astronomy community. Information about each data set published to the Virtual Observatory is entered into a top level, continually updating 'registry', this providing in effect a record of where and what the data set is.

With the advent of these many data sources available through the VO, an emerging challenge is how to offer the astronomer a reliable and usable means to search, retrieve and visualise the relevant data and resources to meet the needs of their particular science problem.

The AstroGrid project has now developed the VOExplorer interface to the VO as part of its Desktop suite of applications. VOExplorer offers a powerful data-centric visualisation for browsing and filtering the entire VO registry using an 'iTunes' type interface. This allows you to bookmark your own personalised lists of resources and to run tasks on the selected resources as desired. Thus VOExplorer significantly simplifies the task of returning relevant data to queries such as 'find me all optical, near-IR and X-ray catalogued objects within 0.1 arcmins of a new transient Gamma Ray Burst (GRB) event' and now even 'find me all transient events from e.g. GCN, IAU alerts previously recorded for this search radius'. HelioScope similarly searches solar archives within a given time interval.

Once selected the user is offered the opportunity to process and act on those data sets. For this purpose a range of data visualisation and analytical tools are now available to pass data into and between directly. These include TopCat for catalogues, Aladin and Gaia for images, SPLAT and VOSpec for spectra.

This talk will describe the technical infrastructure underlying the VOExplorer (including the AstroRuntime interface library) and highlight examples of the use of VOExplorer in supporting science visualisation in cases such as the followup of GRB events.

O8.3 Building Rich Internet Applications in Astronomy

Daniel Magee (UCO/Lick Observatory), Rychard Bouwens (UCO/Lick Observatory), Garth Illingworth (UCO/Lick Observatory)

We present our experiences in building wBUCS, a Rich Internet Application (RIA) for simulating realistic multicolor images of galaxy fields, using Adobe's Flex application framework. Flex provides a complete solution for building rich web-based applications based on Adobe's Flash Player and supplies developers with an integrated set of tools to build and deploy scalable RIAs, including a client runtime, programming model and development environment. Flex supports common design patterns and works with existing development and deployment technologies.

11. Data Mining I

O9.1 Large-scale Pulsar Survey at Arecibo Using ALFA: Data Mining and Management

Jim Cordes (Cornell University)

The 305-m Arecibo radio telescope in Puerto Rico is the largest and most sensitive single-dish radio telescope in the world. The recent addition of the ALFA (Arecibo L-band Feed Array) seven-feed system to the telescope now allows sensitive sky surveys, but at the cost of a sharp increase in data rate and computational demands. This talk concerns the pulsar ALFA survey, and the unique challenges this poses for data mining for new pulsars within the large survey data volume, as well as the required data management strategies. Other surveys using ALFA include all-Arecibo-sky surveys for galaxies in neutral hydrogen and studies of the gas and magnetic field in the Milky Way. Surveys for new pulsars are critical for providing observational constraints on general relativity, detection of nano-Hertz gravitational waves, constraining the equation of state of matter higher than nuclear densities, probing relativistic magnetospheres, and for using propagation effects on pulsar lines of sight to model structure in the Galaxys ionized gas and magnetic field. I will describe the processing pipelines and databases that have been developed for managing raw data and data products for use by a distributed consortium of researchers (The PALFA Consortium). The developed infrastructure will enable access by the general astrophysical community via the Teragrid and by the public, for education and public outreach purposes.

O9.2 Probabilistic Cross-identification of Astronomical Sources

Tamas Budavari (The Johns Hopkins University), Alex Szalay (The Johns Hopkins University), Maria Nieto-Santisteban (The Johns Hopkins University)

We present the general probabilistic formalism for cross-identifying astronomical point sources in multiple observations. Our Bayesian approach is the foundation of a unified framework of object matching, where on top of the spatial information, physical properties can be also considered, such as colors, redshift and luminosity. The new methodology is crucial for multi-wavelength studies leveraging the synergy of today's multi-wavelength observations and to enter the time-domain science of the upcoming survey telescopes.

O9.3 A Method for Exploiting Domain Information in Parameter Estimation

Coryn Bailer-Jones (Max Planck Institute for Astronomy), Carola Tiede (MPIA, Heidelberg), Kester Smith (MPIA, Heidelberg)

Gathering multidimensional information on hundreds of millions of objects is now routine in astronomy. Efficiently processing these data – classifying objects, searching for structure, fitting astrophysical models – is a significant conceptual (not to mention computational) challenge. While standard statistical methods, such as Bayesian clustering, nearest neighbours, neural networks and support vector machines, have been successfully applied to some areas of astronomy, it is often difficult to incorporate domain specific information into these. For example, we often have good physical models for the objects we observe. That is, we can reasonably well predict the observables (e.g. the stellar spectrum or colours) from the astrophysical parameters (APs) we want to infer (such as mass, age and chemical composition). This is the 'forward model'. The task of classification or parameter estimation is then an inverse problem. From the forward model we can calculate a priori the sensitivity of each observable to each AP. In this paper, we present a method in which sensitivity information is explicitly used in parameter estimation. The motivation for this work is two-fold. First and foremost, the addition of domain-specific information should improve the predictive accuracy. Second, but not unimportant, is that it allows an interpretation of how the model works: the sensitivies provide an explicit weighting function of the observables. Apart from making the model more acceptable (and less like a 'black box'), this allows us to identify where we gather higher quality data in order to improve performance further.

O9.4 VIM: A Tool to Explore Your Sources

Roy Williams (Caltech)

VIM (VOTable Integration and Mining) assumes that an astronomer has a list of 'sources', (positions in the sky), and wants to explore archival catalogs, images, and spectra of the sources, in order to identify, select, and mine the list. VIM does this through easy web forms, building a custom table, whose rows are the uploaded source positions, and the columns show data from surveys, such as NED, SDSS, GSC2, 2MASS etc–in fact any VO-registered cone searches can be used by VIM. Image cutouts can be made from any VO-registered SIAP services, and spectrum access is under development. The user could, for example, show together: proper motions from GSC2, name and redshift from NED, magnitudes and colors from 2MASS, and cutouts and spectra from SDSS. VIM can compute columns across surveys and sort on these (eg 2MASS J magnitude minus SDSS g). Data can be gathered by VIM 'while you wait' for a few sources, but for larger sets of sources, VIM utilizes the asynchronous Nesssi services from NVO, that can run thousands of cone and SIAP services overnight. VIM is a client-server application designed to scale up the number of sources by orders of magnitude, because of the separation of the (possibly very large) tables on the server, from the much smaller 'view' of the data on the client side. VIM uses the Stilts library from Mark Taylor as well as Shui Kwok's VOTable library.

O9.5 Needles in a Haystack: Faceted Browsing and the Virtual Observatory

Douglas Burke (Smithsonian Astrophysical Observatory), Michael Halle (Initiative in Innovative Computing at Harvard), Jonathan McDowell (Initiative in Innovative Computing at Harvard), Pepi Fabbiano (Smithsonian Astrophysical Observatory), Martin Elvis (Smithsonian Astrophysical Observatory), Alyssa Goodman (Initiative in Innovative Computing at Harvard)

The standards and services developed by the IVOA allow Astronomers to search through a large amount of data. As the volume of data increases, users find it difficult to easily navigate through their searches, and can feel like they are hunting for a needle in a haystack.

The Smithsonian Astrophysical Observatory and the Initiative in Innovative Computing at Harvard are working together to provide Astronomer-friendly interfaces to the Virtual Observatory. In this presentation I shall discuss our experiments with using the faceted browsing paradigm, familiar to many from its use in eCommerce web sites, to help users categorise their data and navigate through it. Included will be a discussion of how the use of the Resource Description Framework (RDF) language and the Longwell RDF browser helped and hindered the project.

O9.6 PaperScope: Graphically Exploring the ADS

Mark Holliman (University of Edinburgh)

An essential part of every astronomer's work involves identifying published papers relevant to their field of study. Currently this task requires searching the ADS database and browsing web pages that contain the information in a text only format. While functional, this method of searching lacks an intuitive and easy way to identify the connections between papers of similar study. A tool that builds upon the current ADS functionality to provide a more visual method of exploration would be of great use to astronomers everywhere. I will present a new software tool called PaperScope for visualizing the information stored in the ADS database. This tool allows the user to create and manipulate directional graphs representing ADS database search results. These graphs present papers as nodes with edges connecting the nodes wherever one paper cites another. Each node is labelled with pertinent information, and the graph is entirely searchable along all the main categories of information on a given paper. A number of functions are provided for expanding the search (and therefore the graph), accessing paper information, and saving the search in the graph format for future reuse. By using the functionality provided the astronomer can quickly visualize clusters of papers and identify the most important ones within a given field of study, or those of particular interest to them. PaperScope works in real-time to give the user a more intuitive method for exploring the contents of the ADS. The tool has been developed within the EU-funded VOTECH Virtual Observatory project, and is coded in Java while utilizing the standard ADS access methods. The source code and project development notes will be available in due course.

12. Miscellaneous

O10.1 The IAU 2000/2006 Changes to Celestial Reference Systems: A Bluffer's Guide

Patrick Wallace (STFC / RAL)

No sooner had we all learnt to write 'FK5 J2000' next to RA,Decs than the IAU went and changed everything. What are ICRS, BCRS, GCRS, CIRS, TIRS and ITRS? And the CIP and CIO? And the mysterious 'quantity s'? There have even been rumours that sidereal time no longer exists. What is going on, and what difference does any of this make to data analysis?

O10.2 Scientific Data Analysis through Web Services in a Scientific Grid

Carlos Gabriel (ESAC / ESA), Aitor Ibarra (ESAC / ESA), Ignacio de la Calle (ESAC / ESA), Pedro Osuna (ESAC / ESA), Jesús Salgado (ESAC / ESA), Daniel Tapiador (ESAC / ESA)

The Scientific Analysis System (SAS) is the package for interactive and pipeline data reduction of all the XMM-Newton data. Freely distributed by ESA to run under many different operating systems, SAS has been used by every one of the 1500 refereed scientific publications obtained so far from the mission. We are developing RISA, the Remote Interface for Science Analysis, which makes it possible to run SAS through fully configurable web services' workflows, enabling observers to access and analyse data making use of all of the existing SAS functionalities, without any installation/download of software/data. The workflows run primarily (but not exclusively) on the ESAC Grid, which offers scalable vast processing resources, directly connected to the XMM-Newton Science Archive. A first project internal version of RISA has been issued in May 2007, a public release is expected already within this year.

O10.3 Software Modelling of IFU Spectrometers

Nuria Lorente (UK Astronomy Technology Centre)

As the scale and complexity of each generation of telescopes and their instruments increases, the requirement for a means of furthering our understanding of their properties and limitations, from the initial design to the point of commissioning also grows. An effective way of learning about the behaviour of a new instrument is to employ a software simulator to generate synthetic astronomical data, based on the measured (or desired) characteristics of the telescope and instrument in question. The Specsim tool has been developed to model, in software, the operation of Integral Field Unit (IFU) spectrometers, thus giving the science, engineering and operations teams responsible for designing, building and running such instruments a preview of the data products, before their system is operational. Specsim generates synthetic data frames approximating those which will be taken by the spectrometer. The program models user-defined astronomical sources and generates detector frames using the predicted and measured properties of the telescope and instrument. These frames can then be used to illustrate and inform a range of activities, including refining the instrument design, developing calibration strategies and the development and testing of data reduction pipelines. The software has been designed to be expandable. This allows us to easily incorporate future instrument models into the program's existing infrastructure, as required. Currently, Specsim is used to model the Medium Resolution Spectrograph on JWST-MIRI, KMOS on the ESO VLT, and is also employed in the E-ELT design studies.

O10.4 ECSS in the eXtreme

William O'Mullane (ESAC)

The ESAC Gaia team engages in a form of eXtreme programming involving Whiteboards, postits, team code ownership and other things one would associate with eXtreme programming. The application of this approach to the Astrometric Global Iterative Solution (AGIS) is presented. The Gaia Data Processing and Analysis Consortium (DPAC) will follow a series of six month development cycles modeled on the eXtreme programming approach. We are however a large project and within a European Space Agency framework. Typically in this realm the European Committee for Space Standardization (ECSS) standards are required. We will describe how we bring these two realms together and what parts of ECSS may be useful. We also present our eXtreme approach to Data Modeling.

13. Data Mining II

O11.1 Morphological Description of the Large Scale Cosmic Structures (Invited)

Vicent Martínez (Observatori Astronòmic de la Universitat de Valencia)

The distribution of galaxies show features on large scales that cannot be described using standard summary statistics like the two-point correlation function or the power spectrum.

The morphology of these structures, their shape and degree of clumpiness need more specific tools that are able to distinguish between different patterns. Some of these morphological descriptors are based in multiscale methods and make use of Minkowski functionals to provide not only detectors of the singular structures, but also quantitative descriptors of the filaments and sheets found in the large scale distribution of galaxies.

In this talk, we explain how to apply these morphological tools to extract relevant information from cosmological data. In particular, we show applications to the present galaxy redshift surveys and to the next generation of wide and deep galaxy catalogs provided by different ongoing projects that make use of photometric redshifts, like the ALHAMBRA survey.

O11.2 Data Mining Large Surveys: The IPHAS Early Data Release

Eduardo Gonzalez-Solares (University of Cambridge, UK), Nicholas Walton (Institute of Astronomy, University of Cambridge, UK), Mike Irwin (Institute of Astronomy, University of Cambridge, UK), Robert Greimel (Isaac Newton Group of Telescopes, S/C de La Palma, Spain), Janet Drew (Imperial College of Science Technology and Medicine, London, UK), Stuart Sale (Imperial College of Science Technology and Medicine, London, UK)

The IPHAS project is a large systematic survey being carried out with the 2.5-m Isaac Newton Telescope's Wide Field Imaging Camera of the entire northern galactic plane (—b— < 5) with the survey being carried out in the broad band r and i bands and a narrow band H-alpha filter to a depth of approx 20 mag in r.

The survey has a number of key scientific aims focused on both the understanding of large scale structure in our local galaxy, and also the properties of key early and late populations making up the Milky Way. Mapping emission line objects enables a particular focus on objects in the early and late stages of stellar evolution ranging from early T-Tauri stars to late planetary nebulae.

In this paper we highlight the IPHAS Early Data Release, primarily a photometric catalogue of more than 200 million unique objects, coupled with associated image data covering more than 1000 square degrees in three colours. We note how access to the primary data products has been implemented through use of standard virtual observatory publishing interfaces as provided by the AstroGrid system.

Thus, simple traditional access is provided to the main IPHAS photometric catalogue, in addition to a number of common catalogues (such as 2MASS) which are of immediate relevance. Access through the AstroGrid VO Desktop gives a richer range of analysis opportunities, allowing more sophisticated queries of the IPHAS data along with full integration to the wider range of data and services accessible through the Virtual Observatory.

We note how this publication of the IPHAS catalogues and image data represents the largest data set published solely through Virtual Observatory interfaces, pointing the way to a possible paradigm shift in our traditional approach to providing data mining access of large and medium survey data. Examples of the early data mining are given, including the comparison of IPHAS emission line sources as cross matched with sources in 2MASS, noting how these can be used as probes to map extinction across the galactic plane.

O11.3 Robust Machine Learning Applied to Terascale Astronomical Datasets

Nicholas Ball (University of Illinois at Urbana-Champaign), Robert Brunner (University of Illinois at Urbana-Champaign), Adam Myers (University of Illinois at Urbana-Champaign)

We present recent results from the Laboratory for Cosmological Data Mining at the National Center for Supercomputing Applications (NCSA) to provide robust classifications and photometric redshifts for objects in the terascale-class Sloan Digital Sky Survey (SDSS). Through a combination of machine learning in the form of decision trees, k-nearest neighbor, and genetic algorithms, the use of supercomputing resources at NCSA, and the cyberenvironment Data-to-Knowledge, we are able to provide improved classifications for over 100 million objects in the SDSS, improved photometric redshifts, and a full exploitation of the powerful k-nearest neighbor algorithm. This work is the first to apply the full power of these algorithms to contemporary terascale astronomical datasets, and the improvement over existing results is demonstrable. We discuss issues that we have encountered in dealing with data on the terascale, and possible solutions that can be implemented to deal with upcoming petascale datasets.

O11.4 20 Spatial Queries for an Astronomer's Bench (mark)

Maria Nieto-Santisteban (Johns Hopkins University), Tobias Scholl (Technische Universität München), Alfons Kemper (Technische Universität München), Alexander Szalay (Johns Hopkins University)

The astronomy community has put tremendous efforts to provide global access to their distributed scientific datasets. Motivated by the expected data rates of several Terabytes a day and Petabytes a year from upcoming projects such as the Panoramic Survey Telescope and Rapid Response System (Pan-STARRS) and the Large Synoptic Survey Telescope (LSST), we are designing a benchmark for data-intensive astronomical workbenches. We specify the workload based on the type and size of the datasets, typical queries (like points-in-region, region-in-region, and cross-match queries), and other data-analysis tasks. We also define quantitative and qualitative metrics and consider different audiences. The proposed benchmark then allows scalability evaluation (How does my system scale?), and system comparison (How does X compare to Y?). Given the variety of astronomy data-intensive applications and use cases, it is unlikely to find a single best solution. By defining a benchmark, we can offer guidance for system designers to develop productive environments and for end-users to evaluate what environment works best for their personal analysis and research.

O11.5 Finding Outliers in Multivariate Data with Measurement Errors

Somak Raychaudhury (University of Birmingham, UK), Jianyong Sun (chools of Computer Science & Physics, University of Birmingham, UK), Ata Kaban (School of Computer Science, University of Birmingham, UK)

We have developed a new algorithm using robust density modelling for determining outliers in multivariate astronomical data in the presence of errors. Our approach can deal with a reasonable fraction of non-detections (upper and lower limits). Since exact inference is not possible in this model, we develop a tree-structured variational EM solution. Our original contribution in this regime is the handling of errors, which are important in astronomical data mining. We show simple examples of applications, e.g. detecting high-redshift objects from Sloan Survey photometry.

3. Birds of a Feather (BoF) Sessions

B1.1 FITS

W. Pence, IAU FITS Working Group

This Birds-of-a-Feather session will present a summary of current activities related to the FITS data format and will provide a forum for the discussion of current issues. The session will begin with an overview of the changes to FITS that have been approved by the IAU FITS Working Group over the past year, including support for 64-bit integers and the new Registry of FITS conventions.

This will be followed by a discussion of possible activities that might take place over the next year. Suggestions include:

- Document other existing FITS conventions in the Registry
- Convene a technical panel to update the FITS Standard
- Begin drafting a new WCS document on TIME coordinates
- Overhaul the badly out-of-date FITS User's Guide
- Develop a convention for storing color images in FITS
- Consider relaxing some of the current FITS format limitations such as 8-char keyword names and 80-char header records

There will be an open forum at the end for short presentations on any other FITS-related topics.

B1.2 Transient Event Reporting and Response with VOEvent

R. Seaman, A. Allan, R. Williams

Evanescing astronomical phenomena will be key to dramatic scientific discoveries over the next decades. Large telescopes such as LSST and Pan-STARRS will survey the time domain with unprecedented breadth and depth. Networks of nimble robotic response telescopes yearn like locusts anticipating their next meal. A common language for describing observations of transients must span from synoptic discovery to robotic follow-up and through to VO-driven characterization. VOEvent is that lingua franca.

The IVOA VOEvent working group is engaged with the larger astronomical and software communities to develop the VOEvent language and conforming technologies through workshops and BoFs. In addition to brisk status reports from various autonomous astronomy projects, we will wrangle entertainingly over hot topics:

- How to publish your event stream
- How to connect to event streams
- Autonomous response with HTN
- Time series representation
- Event distribution from the LSST firehose
- Controlled vocabulary for event types
- Representing orbital elements
- Authentication and trust for events
- Querying event repositories
- Support for traditional event publications (GCN, CBAT, MPC, ATEL)
- Transport backbone architecture
- Classification and coincidence testing
- Multipart event messages

Representatives of projects in time domain astronomy are encouraged to contribute presentations to the BoF and their expertise to the working groups.

B2.1 Data Mining for Large Scale Astronomical Datasets: Challenges, Milestones and Solutions

S. McConnell, S. Williamson, A. Howes

The session will provide ADASS participants with an opportunity to obtain an overview of existing work in the application of data-mining techniques to astronomical data, identify challenges, discover possible solutions, present research results, contribute their own experiences, express their concerns, and discuss the general issues associated with data-mining of large-scale astronomical datasets. Furthermore, this session will facilitate collaboration between researchers and professionals from different fields, including Astronomy, Computer Science IT. As one of the featured topics for ADASS 2007, data-mining as the focus of this BoF is of utmost relevance to the conference.

Timeline:

- Introduction to the Current State of the Application of Data-Mining Techniques to Astronomical Data (Sabine McConnell, Presentation, 15 minutes plus time for questions)
- Overview of Parallel and Distributed Programming Techniques and Challenges (Scott Williamson, Presentation, 15 minutes plus time for questions)
- Issues in Pre-Processing (Annelie Howes, Presentation, 15 minutes plus time for questions)
- Parallel and Distributed Data-Mining Techniques (optional, Sabine McConnell, Presentation, 15 minutes plus time for questions)
- Short contributions by participants in the form of short presentations, to be solicited after acceptance of the session.

Discussion:

- Which astronomical problems and/or data are suitable for data-mining applications?
- How can surveys facilitate the data-mining process?
- Identification of major challenges and possible solutions
- Identifications of possibilities for collaboration etc.

Summary and Conclusions

B2.2 IRAF Users and Developers

M. Fitzpatrick, F. Valdes, R. Seaman, N. Zarate

IRAF development within the NOAO Data Products Programs (DPP) has recently been resumed in support of other DPP efforts such as the NVO and pipeline processing. This development will provide new releases of external packages, the core IRAF system and the X11IRAF tools that will be of interest to the wider user community. Support for these new projects, how feedback from users helps drive new development, and a new collaboration between the user-community hosted by IRAF.net and NOAO/DPP projects define a new model for the future of IRAF development.

We propose a BoF session for IRAF users and developers that will serve as a 'Town Hall' style meeting to answer questions that the above statements will surely raise, as well as a more traditional BoF with prepared presentations from the organizers and as those solicited from the community with plenty of time reserved for Q&A. Specific topics to be covered include:

- Status and plans for the IRAF.net web site.
- IRAF Development within NOAO and what it means for users.
- Overview of new software releases, including:
  - What's new in IRAF and future plans
  - Developing your own NVO Applications in IRAF (new)
  - IR data reduction in IRAF (new)
  - X11IRAF Developments

4. Focus Demos

F1 New Developments for Aladin

Thomas Boch (CDS - Observatoire de Strasbourg)

We will present and demo the features recently developed in Aladin, including the management of very large images (several gigabytes), a plugin mechanism allowing to extend easily Aladin capabilities, an API allowing to control Aladin from IDL, as well as the visualization of telescope instruments footprints.

F2 VirGO: A Visual Browser for the ESO Science Archive Facility

Fabien Chereau (ESO)

VirGO is the next generation Visual Browser for the ESO Science Archive Facility developed by the VO Systems Department. It is a plug-in for the popular open source software Stellarium adding capabilities for browsing professional astronomical data. VirGO gives astronomers the possibility to easily discover and select data from millions of observations in a new visual and intuitive way. Its main feature is to perform real-time access and graphical display of a large number of observations by showing instrumental footprints and image previews, and to allow their selection and filtering for subsequent download from the ESO SAF web interface. It also allows to load external FITS files or VOTables, to superimpose DSS background images, or to see the sky in a 'real life' mode as seen from the main ESO sites. All data interfaces are based on Virtual Observatory standards which allows access to images and spectra from external data centers, or to interact with the ESO SAF web interface or any other VO applications supporting the PLASTIC messaging system.

F3 PaperScope in Use: Visually Exploring the ADS

Mark Holliman (University of Edinburgh)

This demo will show how PaperScope can be used to explore the information contained in the ADS. The functionality of the PaperScope tool will be highlighted to demonstrate how it can vastly improve an astronomer's ability to locate papers of interest to their study. It will walk through a standard use case of searching for papers from a given author, selecting a starting paper for the graph, and then expanding the graph by selecting other related papers to display their interconnections. As the graph is expanded a clear visual picture of the relationships between the papers will become apparent. The demonstration will include using the visual tools PaperScope provides to manipulate and manuever the elements on the graph so that it can be easily understood and interpretted. Finally, future development ideas for the PaperScope tool will be presented, including how it can be connected to the VO for even better functionality.

5. Floor Demos

D1 ESA Science Archives and VO tools

Christophe Arviset (ESA)

The Demo booth will give the possibility to demonstrate the latest functionalities of the ESA Science Archives located at ESAC, Spain. In particular, the following archives will be available :
– The ISO Data Archive (IDA), `http://iso.esac.esa.int/ida/`
– The XMM-Newton Science Archive (XSA), `http://xmm.esac.esa.int/xsa/`
– The Integral SOC Science Data Archive (ISDA), `http://integral.esac.esa.int/isda/`
– The Planetary Science Archive (PSA), `http://www.rssd.esa.int/psa/`, both the classical and the map-based Mars Express interfaces

Furthermore, the ESA VO tools will be accessible for demonstration as well, in particular:
– ESA VO web portal : `http://esavo.esac.esa.int/`
– VOSpec : VO tool to access and display spectral information from VO resources (both real observational and theoretical spectra), including access to Lines database
– ESA VO full harvestable VO Resource registry

D2 INTEGRAL Visualation Tool and Explorer (INVITE)

Pieter Jan Baeck (ESAC/ESA)

The INtegral VIsualisation Tool and Explorer (INVITE) has been available as part of the (ISOC Science Data Archive) ISDA since Dec 2006. It provides an easy and convenient method of manipulating light-curves from INTEGRAL and many other instruments.

INVITE is a compact (1.5 Mbyte) programme written entirely in Java. It needs only for a Java Run time Environment (JRE) of version 1.4 or higher to be available. This means it can be launched from the ISDA and run on the client machine as a Java applet. Subsequent operations on even relatively large data-sets are rather rapid, since it then runs entirely on the client side. INVITE can also be used in a stand-alone mode to manipulate data from one or more OGIP compliant FITS light-curves.

INVITE allows the user: to simultaneously display a number of light-curves, combine light-curves from different energy bands, generate hardnessratios and to re-bin the light-curves in time. If a number of light-curves covering adjacent bands are available, these can be used to generate a 'broadband' spectrum which can be passed to XSPEC.

D3 The ESO Pipeline Processing Environment

Klaus Banse (European Southern Observatory)

By now, almost all VLT instruments on Paranal have their data reduced with pipelines based on the Common Pipeline Library (CPL). Different tasks within these pipelines, the 'recipes', are executed to perform all the necessary reduction steps on the instrument data either automatically (operational pipelines) or explicitely via the graphical Gasgano tool or the command-line based EsoRex facility.

Another option to execute pipelines and individual recipes, as well as legacy applications and other tools, is offered by the ESO Reflex graphical workflow system developed by the Sampo team. This offers great flexibility to control interactively the processing of individual tasks of a given pipeline and assess the quality of intermediate data products.

All these tools will be demonstrated together with the 'classic' ESO-Midas data analysis system.

D4 The Astronomical Medicine Project: 3D Visualization for Astronomy

Michelle Borkin (Initiative in Innovative Computing, Harvard University)

The Astronomical Medicine project at the Initiative in Innovative Computing (IIC) at Harvard University is developing tools and techniques that address common research goals in both astronomy and medical imaging. We will demonstrate our astronomy visualization tools including 3D Slicer, which is capable of displaying 3D volumes (e.g. FITS cubes) as slices and isosurface models. 3D Slicer was originally developed as a medical imaging and visualization application at the Brigham and Women's Hospital's Surgical Planning Lab. All of the project's software is collaboratively-developed, freely-available, and open source. We will also demonstrate, using 3D Slicer and other imaging programs, the utility of stereoscopic displays to explore the structure of multi-dimensional astronomy data. For more information about the Astronomical Medicine project and their software, go to: `http://astromed.iic.harvard.edu`

D5 The ESO Science Archive Facility

Markus Dolensky (European Southern Observatory)

The ESO Science Archive Facility is significantly changing its appearance. At a first glance the new look & feel of the web interface is apparent. Even more prominent is the new visual browser for interactive and google-earth-style data discovery. It is fed by a stream of previews and advanced data products and features instrumental footprint overlays. Virtual Observatory standard interfaces allow additional programmatic access to images and spectra as well as inter application exchange and compatibility. A new submission interface allows so called ESO large programmes and selected projects to upload data products to the archive.

A lot of innovation took place under the hood in the past years since the creation of the VO Systems Dept. A dedicated query server as well as a metadata warehouse were set up and populated. The migration of current interfaces and data to the new system will continue for some time but all above mentioned features are already on display at the booth incl. access to the reduced spectra from two instruments (HARPS, UVES).

D6 The Canadian Astronomy Data Centre

Daniel Durand (National Research Council Canada)

The Canadian Astronomy Data Centre

The Canadian Astronomy Data Centre (CADC) hosts many data collections from a wide range of wavelengths, both from ground- and space-based facilities: CFHT, Gemini, MOST, HST, FUSE, CGPS and JCMT. The data collections include often raw and processed data. In addition the CADC is also producing higher level data products for a number of important collections such as HST and CFHT. The CADC also provides SIA access to all its calibrated data and an access to a multiwavelength search tool named Octet, its main CVO tool, allowing users to find coincidental data through the CVO collection.

D7 EZ - A VO Compliant Tool, for Automatic Spectral Parameters Measurement

Marco Fumana (INAF - IASF Milano)

We wish to present EZ, a software for automatic measurement of spectroscopic parameters, with a special attention to redshifts. It is a open source software publicly released in June 2007, on the PANDORA web site: `http://cosmos.iasf-milano.inaf.it/pandora/EZ.html` EZ main ingredients are: a custom spectrum template set, a combination of cross-correlation and fitting algorithms and a decisional tree which drives EZ computations. The software supports the PLASTIC messaging system, and it is also able to retrieve data from the Virtual Observatory, accessing SSA services through the VO registries. During its development, EZ has been tested on VVDS and zCOSMOS data, giving a redshift measurement accuracy success rate of 80% (with peaks of 95%). We are currently adding new functionalities to measure main spectral features, like line equivalent widths and fluxes. We ask for a standard demonstration to show 'on line' how to analyse spectra with EZ. We will also explain how it can be customized and show interaction with Virtual Observatory and others PLASTICized software.

D8 The CDS Services

Françoise Genova (CDS, Observatoire astronomique)

The present status of the CDS services will be presented.

D9 Space Walker. The Cognitive Visualization System with the Dynamic Projection of Multidimensional Data.

Vladimir Gorokhov (Saint-Petersburg State University of Engineering and Economics)

The project of data cognitive visualization system-'Space Walker' is presented. The main issues of project are: 1. Development of procedures and methodology of work in the contemporary systems of the cognitive machine drawing, which ensure the application of these systems with the analysis of the large volume of the experimental data of the obtained in the region natural sciences, and also with monitoring of ecological, technical, social, economic and political systems. 2. Development of the philosophical aspects of the cognitive processes of cognitive machine drawing. 3. Formation of ergonomic recommendations and requirements for software of the support of making decisions and visual programming, that use the developed procedures and methodologies. 4. Resolving the fundamental problems of the use of the methodology of experimental sciences developed in phenomenology is assumed in connection with the data reduction processes. The approach to the use of methods of phenomenology proposed in the project is fundamentally new. 5.Creation of algorithms and software of the cognitive visualization of the multidimensional massifs of data. The creation of program products for the solution of the problems enumerated above in turn requires the practical mastery of the entire complex of achievements in the field of mathematical statistics, theory of illegible sets, cognitive machine drawing, cognitive psychology and, first of all, the theory of knowledge (gnosiology). Project base on the ground of possibility use already acting program software intellectual support adopted solution in task control complex system with deep a priori uncertainty.

D10 Building an Astronomical Database with Saada.

Laurent Michel (Observatoire de Strasbourg)

A lot of astronomers would like to share datasets with the community but have no manpower to develop databases providing functionalities with high scientific level. The Saada project aims to help them by automatically generating from Fits files or VOtables databases (SaadaDBs) located on any Linux, Windows or Mac computer. SaadaDBs can simultaneously host heterogeneous sets of spectra, images and source lists. Data stored in SaadaDBs can be correlated each other with qualified links helping for example for cross-identifications or for modeling some other scientific content. The query engine is based on a specific language (SaadaQL) fitting well the data model. In addition with classical astronomical queries, it can process constraints on correlated data. Databases created by SAADA can be accessed by a WEB interface allowing data browsing or data selection with complex queries. They also implements VO protocols providing then a solution to publish local data into the VO.

D11 Data Mining in Astronomy

Sabine McConnell (Trent University)

We provide an overview of existing data-mining applications to astronomical problems, including a demonstration of our grid. In addition, we demonstrate a searchable database for publications related to data mining in astronomy.

D12 The NOAO Data Products Program: Data Management and Data Processing in Support of the VO and the US OIR System

Robert Seaman (National Optical Astronomy Observatory)

The NOAO Data Products Program is responsible for the development and operation of the data management system for NOAO and affiliated observatories, and for the scientific support of users accessing the Virtual Observatory through our tools and services.

D13 UK ATC Software Group

Andrew Vick (UK ATC)

The UK ATC Software Engineering Group provides software solutions for a broad range of projects in Astronomy. Our work spans the entire observing life cycle, from observing preparation, through instrument control to data reduction. We will be demonstrating a variety of this work including:

- Observing preparation; the Alma Observing Tool and Vista/WFCam Survey Definition Tool
- Instrument Simulation; Specsim
- Instrument control; Vista mirror sensing
- Data reduction; Alma Pipeline

We will also be highlighting the facilities of the group and the UK ATC, and providing information on the latest studies we are working on (Gemini PRVS/WFMOS, ELT Eagle and others).

D14 The AstroGrid Virtual Observatory Service

Nicholas Walton (IoA, University of Cambridge)

AstroGrid is the UK's Virtual Observatory System. After an initial release in April 2005, the new October 2007 beta release offers a number of significant new capabilities, helping the astronomer find, get and work with a wide range of astrophysical data.

In particular a major new user interface is presented, the VOExplorer, which provides simple yet powerful methods to locate data resources in the Virtual Observatory, and once selected, offer the user options as to how to use these resources.

VOExplorer is accompanied by a range of applications through the VODesktop suite which help the scientist work with the data that they discover through the VO. These applications include:

1. 'query runner' (which enables catalogues held in remote databases to be queried),
2. VOScope – which provides a graphical representation of data resources over a patch of sky, a patch of the solar disk, or a time range respectively.

3. 'application runner' – a common interface to a wide range of well known astronomical applications.

In addition the AstroGrid release provides scripting interfaces, via for instance Python, Perl, IDL (soon), to the VO.

Data retrieved from remote data centres can be staged in remote 'VoSpace' storage blocks, passed into server side applications, and visualised on the desktop, passed auto-magically (utilising the Plastic messaging protocol) into a range of relevant tools such as TopCat and Aladin.

The AstroGrid demonstration will present the full range of its current capabilities. Additionally members of the AstroGrid team will be on hand to discuss how application developers can interface their data and applications to AstroGrid both on the server side (utilising the AstroGrid DSA and CEA components) and on the client side (through the PLASTIC protocol). Finally, data providers will discover how they can publish their data using AstroGrid access mechanisms to the VO.

Use AstroGrid Now : just go to `http://www.astrogrid.org/launch` to find out how.

6. Poster Presentations

1. Grid Computing and the VO

P1.1 An archive and tools for cosmological simulations inside the Virtual Observatory

Patrizia Manzato (INAF - Trieste Astronomical Observatory), Marco Molinaro (INAF - Trieste Astronomical Observatory), Federico Gasparo (INAF - Trieste Astronomical Observatory), Riccardo Smareglia (INAF - SI/Trieste Astronomical Observatory), Giuliano Taffoni (INAF - SI/Trieste Astronomical Observatory), Fabio Pasian (INAF - SI/Trieste Astronomical Observatory)

The Italian Theoretical Virtual Observatory (ITVO) is a test-bed project for the inclusion of theoretical data and related tools inside the International Virtual Observatory Alliance (IVOA). We started cooperating with the IVOA community to develop standards and tools applicable to the theoretical data obtained from cosmological simulation. The database structure has been created with the main purpose of defining a structure for the cosmological simulations, generic enough to be able to ingest metadata of many types of simulations (N-body, N-body+SPH, Mesh, N-body+AMR, etc.). The goal is to provide a searching criteria thanks to which a single query can get data from different kinds of simulations archives, and develop appropriate IVOA tools to visualize and analyze the data, and finally make possible an easy comparison between theoretical and observational data. VisIVO has been used to find and visualize N-D boxes data, whereas Aladin has been modified to study the 2-D maps and permit the search of simulated galaxy clusters; we have now also generated a code that creates on-the-fly the profiles of ten quantities of the simulated galaxy clusters produced by Gadget-2 code which can be easily visualized by TOPCAT application. All of these tools can be connected to each other using the PLASTIC hub, a software specifically designed for interoperability between astronomical VO applications. This project is being developed as part of VO-Tech/DS4, ITVO and VObs.it assets.

P1.2 Construction of multiple-catalog database for JVO

Masahiro Tanaka (National Astronomical Observatory of Japan), Yuji Shirasaki (National Astronomical Observatory of Japan), Masatoshi Ohishi (National Astronomical Observatory of Japan), Yoshihiko Mizumoto (National Astronomical Observatory of Japan)

We present a development of an efficient query system for multiple catalogs.

In a case where a VO user collects all the available information about an astronomical object, it is necessary to send queries to all the VO services. However, this would be inefficient since most services tend not to have data on the target object. We thus developed a new query system for users to efficiently find all the available information from multiple catalogs. This system collects basic data (coordinates and fluxes) of astronomical objects from the VO data services and major astronomical catalogs, and store them into a local database built with PostgreSQL. The design of this database is one of key issues; an efficient query mechanism for more than billions of objects is required. We employed the Table-Partitioning technique, and developed a method to build queries for the partitioned tables. We compared our method with the partitioning function of PostgreSQL, and found our method is more efficient by a factor of 6 to 150. We also discuss the architecture of this system.

P1.3 A practice of an optical identification of the RC catalog radiosources sample with VO tools

Olga Zhelenkova (SAO RAS), Aleksandr Kopylov (SAO RAS), Vladimir Chernenkov (SAO RAS)

The interrelationship between the objects of astronomical catalogs in the different ranges of electromagnetic spectrum and their association into the real astrophysical source has obvious scientific interest. Astronomical community actively uses the Internet for the access to the scientific information, but the heterogeneity of data and their constantly growing volume is the certain difficulty. The gathering of information even about one celestial object is time-taking work because of a large quantity of resources, data access, formats of the obtained results and formats of input data of the program applications, used for further analysis. The community activity on the creation of the architecture of information interaction, standards, format specifications, data models and services, which increase the efficiency of work with the data, coordinates International Virtual Observatory Alliance (IVOA). Within the framework of this activity is created system Astrogrid an and TOPCAT (`http://www.star.bris.ac.uk/~.mbt/topcat/`), which make it possible to realize the distributed computing and data access. AstroGrid developers selected ten typical tasks, connected with physics of stars, galaxies, interstellar medium and the Sun, whose solution is impossible without the distributed computing and requests to the different information sources, analysis and visualization of the large volumes of data. In the sense of information technologies, we can represent the tasks are as a form of scenarios. This is the certain type assignment of the actions, produced for extraction and data analysis from www-resources. AstroGrid developers decomposed scenarios on the component tasks, on the base that created the functionality of the system. We decided to analyze the usage of existing software tools for investigation the radio sources list. The radio sources identification can be considered as the sequence of the interconnected tasks, beginning from the extraction of data, their analysis and visualizations of results. Optical identification is not simple task for the automation because the radio sources are extensive, has complex structure and, therefore, one source can be fetch in the catalog as a few objects. As the radio sources list we used the RC sample, namely the objects, which fell into the region of surveys FIRST and SDSS (8h11m-16h25m on the right ascension and with the width on the declination, which includes all sources RC, with the total area of 120sq.deg.). The RC catalog has insufficient coordinate accuracy for the optical identification; therefore is necessary the refinement of coordinates by cross matching with the more precise radio catalog. We used NVSS as the reference coordinate catalog. For the program cross-identification of the RC sample, we tested the different algorithms in the IVOA program applications, namely, the search of the nearest neighbors with different radii of the separation between the adjacent sources and the algorithm from the SPECFIND package, which considers different angular resolution of compared radio catalogs. The algorithms gave the low percentage of coincidences, and it is required the their modification, i.e., the addition of constrains and conditions, which can be used for the binding rows of different catalogs into one physical object not only coordinate coincident, but also other conditions, caused by the radio source properties. We are carrying out the detailed identification of the RC sample to study of the properties of radio sources at the frequency of 3.9GHz and find possible empirical constrains for changing the cross matching algorithm For the work we use the catalogs and surveys in the optical and the radio-frequency band – VLSS, TXS, NVSS, GB6, FIRST, SDSS, 2MASS, USNO-B1. We evaluated the fraction of single-component and multicomponent radio sources in survey FIRST, on basis of which (after the identification of the RC catalog objects with it) carried out optical identification. Spectral data in the radio-frequency band from 74MHz to 4.85GHz are acquired for the sample. For 60% of radio sources identified with the objects of the radio catalogs we discovered optical candidates in SDSS survey.

P1.4 Distributed Data Analysis: Applications in Astronomy

Scott Williamson (Trent University), Randy Neals (Trent University), Annelie Howes (Trent University), Nick Powers (Trent University), Sabine McConnell (Trent University)

Given the cost of dedicated computer resources and infrastructure to support large computer installations, a method for utilizing existing idle computational power is desirable. We have developed applications that are implemented on the Trent Enterprise Desktop Distributed System, a desktop computational grid network located at Trent University, Canada.

Initial use of the grid includes the application of data-mining techniques to both Millenium Simulation and

Canadian Galactic Plane Survey data. Numerous issues arise from the use of such a grid, including: trust of results from the computational nodes, required expertise and identification of appropriate problem types. This differs from the existing large distributed projects such as SETI@homeand Ontario's SHARCnet in that there is control over the compute nodes and that dedicated resources are not required.

P1.5 IDL Grid Web Portal

Pietro Massimino (INAF - Astrophysical Observatory of Catania), Alessandro Costa (INAF - Astrophysical Observatory of Catania)

Image Data Language is a software for data analysis, visualization and cross-platform application development. The potentiality of IDL is well-known in the academic scientific world, especially in the astronomical environment where thousands of procedures are developed by using IDL. The typical use of IDL is the interactive mode but it is also possible to run IDL programs that do not require any interaction with the user, submitting them in batch or background modality. Through the interactive mode the user immediately receives images or other data produced in the running phase of the program; in batch or background mode, the user will have to wait for the end of the program, sometime for many hours or days to obtain images or data that IDL produced as output: in fact in Grid environment it is possible to access to or retrieve data only after completion of the program. The work that we present gives flexibility to IDL procedures submitted to the Grid computer infrastructure. For this purpose we have developed an IDL Grid Web Portal to allow the user to access the Grid and to submit IDL programs granting a full job control and the access to images and data generated during the running phase, without waiting for their completion. We have used the PHP technology and we have given the same level of security that Grid normally offers to its users. In this way, when the user notices that the intermediate program results are not those expected, he can stop the job, change the parameters to better satisfy the computational algorithm and resubmit the program, without consuming the CPU time and other Grid resources. The IDL Grid Web Portal allows you to obtain IDL generated images, graphics and data tables by using a normal browser. All 'conversations' from the user and the Grid resources occur via Web, as well as authentication phases. The IDL user has not to change the program source much because the Portal will automatically introduce the appropriate modification before submitting the IDL program to the Grid. When the user wishes, he will be able to check the status of his program and outputs, if any, because the Portal will assign the users a specific and univocal session identification number. This Web portal runs in the Trinacria Grid Virtual Laboratory and fully exploits the power of this grid in terms of CPU and data storage.

P1.6 Nbody Simulations in the Weak Gravitational Lensing field using new HPC-Grid resources: the PI2S2 project

Ugo Becciani (INAF - Osservatorio Astrofisico di Catania), Vincenzo Antonuccio (INAF - Osservatorio Astrofisico di Catania), Alessandro Costa (INAF - Osservatorio Astrofisico di Catania), Marco Comparato (INAF - Osservatorio Astrofisico di Catania)

We presents the main project of the new grid infrastructure and the researches, that is already started in Sicily and will be completed in the next year. The PI2S2 project of the COMETA consortium is funded by the Italian Ministry of University and Research and will be completed in 2009. Funds are from the European Union Structural Funds for Objective 1 regions. The project, together with a similar project called Trinacria GRID Virtual Laboratory (Trigrid VL), aims to create in Sicily, a computational grid for e-science and e-commerce applications with the main goal of increasing the technological innovation of local enterprises and their competition on the global market. PI2S2 project is to build and develop an e-Infrastructure in Sicily, based on the grid paradigm, mainly for research activity using the grid environment and High Performance Computer systems. As an example we present the first results of a new grid version of FLY a tree Nbody code developed by INAF Astrophysical Observatory of Catania, already published in the CPC program

Library, that will be used in the Weak Gravitational Lensing field. This new version of FLY will be also used for numerical simulations to provide the physical framework to allow quantitative predictions of the evolution of the galaxy population in the program 'Galaxy Formation at High-redshift: Quantifying Black Holes' feedback on the evolution of the visible Universe'.

P1.7 Using ESO Reflex with Web Services

Pekka Järveläinen (CSC), Richard Hook (European Southern Observatory), Tero Oittinen (Observatory, University of Helsinki), Sami Maisala (Observatory, University of Helsinki)

The Sampo project is a contribution from Finland when it joined ESO. Sampo is looking into future options for ESO data reduction and has developed a graphical workflow system (ESO Reflex), based on Taverna, and primarily intended to be a flexible way of running ESO reduction recipes along with other legacy applications and user-written tools. As a separate small side-project the team has been looking at the use of ESO Reflex with astronomical web services, primarily those developed within the auspices of the Virtual Observatory.

ESO Reflex can use the Taverna web services features that are based on the Apache Axis SOAP (Simple Object Access Protocol) implementation. Taverna is a general purpose web service client, and requires no programming to use such services. However, Taverna also has some restrictions: for example Taverna has no numerical types such integers. The Taverna preferred binding style is document/literal wrapped, but most astronomical services publish the Axis default WSDL using RPC/encoded style. Despite these limitations we have created example workflows using the Sesame name resolver service at CDS Strasbourg, the Hubble SIAP server at the Multi-Mission Archive at Space Telescope (MAST) and WESIX image cataloging and catalogue cross-referencing service at the University of Pittsburgh. ESO Reflex can also pass files and URIs via the PLASTIC protocol to visualisation tools and has its own viewer for VOTables.

This poster will illustrate how such workflows are developed and give examples of their use.

P1.8 Web services at TERAPIX

Olivier Ricou (EPITA), Anthony Baillard (Institut d'Astrophysique de PARIS), Emmanuel Bertin (Institut d'Astrophysique de PARIS), Frederic Magnard (Institut d'Astrophysique de PARIS), Chiara Marmo (Institut d'Astrophysique de PARIS), Yannick Mellier (Institut d'Astrophysique de PARIS)

We present an implementation of V.O.-compliant web services built around software tools developed at the TERAPIX centre. These services allow to operate from a remote site several pipeline tasks dedicated to astronomical data processing on the TERAPIX cluster, including the latest EFIGI morphological analysis tool.

P1.9 Astrophysics in the EGEE Grid

Claudio Vuerli (INAF - SI and OA Trieste), Fabio Pasian (INAF - SI and OA Trieste), Giuliano Taffoni (INAF - SI and OA Trieste)

EGEE, the most important European Grid Infrastructure funded by the EU Commission, is now in the process of submitting a proposal within the EU 7th Framework Programme to start the third phase (EGEE-III) of the project.

The Astronomy and Astrophysics (A&A) Community has proven to be particularly attractive for EGEE, since its typical applications are considered strategic, i.e. challenging enough to be chosen as good validators of the EGEE Grid infrastructure. Conversely, a call for astrophysical applications launched in the past months gathered many responses from groups of astronomers interested in contributing applications to be gridified. This positive answer is a further demonstration that the community of astronomers who look at the Grid as the right technology for many aspects of their everyday work is rapidly growing.

In the 2008–2009 framework, the plan is to support of the gridification of selected astrophysical applications using EU funds. In the meantime, a consistent development activity on the Grid middleware is being carried out by a number of research groups of the A&A Community. The goal is to enhance the capabilities of the current Grids to make them able to fully meet the requirements of typical astronomical applications and also of other disciplines, and to bridge the Grid and the Virtual Observatory. Both EGEE and the A&A Community, therefore, can mutually benefit of a stronger synergy.

P1.10 BaSTI: the Virtual Observatory meets the computational Grid

Fabio Pasian (INAF - Osservatorio Astronomico di Trieste), Santi Cassisi (INAF - Osservatorio Astronomico di Teramo), Patrizia Manzato (INAF - Osservatorio Astronomico di Trieste), Federic Gasparo (INAF - Osservatorio Astronomico di Trieste), Adriano Pietrinferni (INAF - Osservatorio Astronomico di Teramo), Maurizio Salaris (John Moore University, Liverpool)

In Astronomy, the possibility to use a large set of stellar evolution models, spanning a wide range of stellar masses and initial chemical composition, is a necessary pre-requisite for any investigation aimed at interpreting observations of Galactic and extra-Galactic stellar populations. FRANEC is a numerical code designed to address this problem. FRANEC-G is the version designed to work on the EGEE-II grid environment. This code takes full advantage of the use of the grid infrastructure and allows to generate a large amount of simulations in one shot. The results of the simulations are available from the BaSTI database via a web portal.

We present the new version of this web portal that is now a facility integrated in the Virtual Observatory and EGEE-II: it provides data access thanks to prototype standards being defined within IVOA, and numerical calculations and data storage through the EGEE-II facility.

On the basis of a user request, the BaSTI facility provides access to data stored in an Oracle 10g database and, in the case data are not available, a batch of jobs is submitted and executed on the EGEE-II grid infrastructure. The facility is in charge of directing the job execution and control, and of storing the results in the database. The results of grid simulations are stored both in the databases and in the EGEE-II 'Grid file system'. Data is then available for both grid and VO users.

The VO and EGEE-II interoperation can be done on the basis of common single-sign-on operations that allow users to authenticate on both the VO resource and the grid one (another IVOA prototype), and on the possibility of using the EGEE storage system also for VO data.

BaSTI V4.0 represents an excellent example of a resource joining the Virtual Observatory with a production grid environment.

P1.11 Bridging VO and computational grid applications

Giuliano Taffoni (INAF OATS), Claudio Vuerli (INAF OATS), Fabio Pasian (INAF OATS)

The term 'Grid' in the VO context has mainly been used to indicate a set of interoperable services. This is rather different from the approach other scientific communities are taking mainly based on using the Grid for computational tasks. Many astrophysical applications, mainly in the theoretical and modeling fields already make massive use of the computing power the Grid is able to offer. The simulated data produced are to be used in the framework of a Theoretical VO.

Within this framework, it appears as extremely important to interconnect the VO and the computational grid infrastructure. Harmonization of the VO infrastructure and user tools with the developments being carried out within the various national and European Grid projects is an important goal to achieve.

This presentation describes the solutions currently found or being pursued in this area, and their applicability to the VO. We are presenting the work done in the framework of the Euro-VO Data Center Alliance project to allow the Data Centers to take full advantages of the Grid computational and storage resources in particular the ones offered by EGEE-II infrastructure. A two-way infrastructural approach is proposed for bridging distributed computing facilities with data services, and vice-versa, within the VO standards.

P1.12 Embedded Processing for the Virtual Observatory

Robert Seaman (National Optical Astronomy Observatory)

The Virtual Observatory is often taken to be synonymous with ‘a federation of archives’. This leads one naturally to think only of big iron solutions hosted at large institutions. Rather, the VO represents a whole flotilla of astronomical computing solutions ranging in size from flagship data centers down through the frigates, sloops and pinnaces of semantic science infrastructure. We will discuss the inflatable dinghies of the Virtual Observatory, focusing on the ‘last mile’ and first mile of the creation and transport of a VOEvent packet from discovery to follow-up.

P1.13 Extreme Computing Applications on DEISA Grid

Claudio Gheller (CINECA)

The DEISA supercomputing Grid is a European research infrastructure resulting from the integration of national High Performance Computing (HPC) centers. The main objective of DEISA is to deploy and operate a persistent distributed supercomputing environment with continental scope and to enable scientific discovery across a broad spectrum of science and technology. Such infrastructure is expected to support ultimate challenging supercomputing applications. The DEISA Extreme Computing Initiative (DECI), launched in May 2005 by the DEISA Consortium, has the goal of enabling a number of ‘grand challenge’ applications in all areas of science. These leading, ground breaking applications must deal with complex, demanding and innovative numerical simulations that would not be possible without a large scale infrastructure. At present, more than 50 DECI projects have been supported, most of them being succesfully completed. We will give an overview of the present status of development of the DEISA infrastructure, pointing out its most innovative and effective aspects. Furthermore, we will present the most interesting completed DECI jobs, referring, in particular, to astrophysical applications. Finally, we will present the developments and improvements of the infrastructure expected for the next future.

P1.14 Standard Service Validation for the Virtual Observatory

Raymond Plante (National Center for Supercomputer Applications)

Standard service protocols, such as the Simple Image Access Protocol (SIAP), make it possible to access a wide variety of data from many different archives in the virtual observatory (VO), all through a common interface. They also open the door for higher level applications capable of more automated discovery and analysis. However, our experience in the VO over the past four years is that the effectiveness of such applications is greatly diminished when the underlying services do not actually behave according to the specified standards. The application has a better chance of completing successfully if can actually determine which services are known to behave properly ahead of time. Thus, to improve the overall robustness of the VO, there is a great need for validating services–that is, verifying that services are actually compliant with the standard they purport to support. These validaters need to be easily accessible by providers to test the service and solve compliance problems before it is published. VO Registries need validaters to continually assess the health of the VO. In this paper, I will describe a software package I developed and deployed as web services that validates instances of Simple Cone Search, Simple Image Access, and the Registry Harvesting Services. I will discuss the role validaters can play in the VO publication process and in the general maintenance of the VO. Finally, I will discuss the limits of software-based validation and the need for humans in the validation process.

P1.15 A new easy configuration tool to VO enable SItools framework

Jean-Charles Meunier (LAM), Christian Surace (LAM), Jean Charles meunier (LAM), Christophe Ordenovic (LAM), Emmanuel Vallot (LAM)

SITools provides a framework in order to make an easy way of integration of data and an accessibility throughout Web interfaces. The non homogeneous data samples are by this way shown as single and simple objects. this framework can deal with several data as spectra, images, simulations as unified samples. We provide a new JAVA interface for an easy configuration of the databases and linked interfaces.

P1.16 On-demand MERLIN radio interferometry images using AstroGrid and RadioNet

Anita Richards (Jodrell Bank Observatory), A.M.S. Richards (JBO, University of Manchester)

The MERLINImager has been developed using the efforts of the MERLIN, RadioNet and AstroGrid teams. A typical radio interferometry observation covers 50 square arcmin and can produce images with, potentially, about 10 million 10-mas pixels. The MERLIN Archive contains calibrated visibility data which are imaged on-demand, using IVOA data-management standards, in a web service implemented with AstroGrid CEA components and controlled by the AstroGrid desktop. This provides a web service to run the RadioNet python-based package ParselTongue at Jodrell Bank Observatory, to extract an image at the size and resolution requested, optionally further restricted by time, frequency etc. We are now launching a similar image cutout service for the MERLIN+VLA HDF(N) Deep Field. These services give any astronomer access to customised interferometry images without the need to learn domain-specific jargon or software. We look forward to more sophisticated user-steered, VO-mediated pipelines to be employed for e-MERLIN.

P1.17 PI2S2 Project: Web services for an archive of cosmological simulations in the Theoretical Virtual Observatory

Alessandro Costa (INAF Astrophysical Observatory of Catania), Ugo Becciani (INAF - Osservatorio Astronomico di Catania), Vincenzo Costa (INAF - Osservatorio Astronomico di Catania), Alessandro Grillo (INAF - Osservatorio Astronomico di Catania), Marco Comparato (INAF - Osservatorio Astronomico di Catania), Claudio Gheller (Cineca - Bologna)

A cosmological simulation archive can include an extremely large amount of data, that imply a strong difficulty to analyse move and download these kind of data, so it is important to develop a system that analyse the cosmological data where data are stored. The main target of this work is to build a software layer that can easily allow us to handle data. The challenge is to develop and make available to the community a complete set of services for data handling by providing a user-friendly access to a huge amount of heterogeneous data and also an optimised way to process and analyse these data in a distributed environment. We present a set of web services aimed at offering services such as SNAP (Simple Numeric Access Protocol) and Randomizers dealing with different data formats. The web services technology allow us to run a particular task (a SNAP job, for instance) close to its data.

P1.18 PocketVO - A Simple Tool for Accessing Multiwavelength Images through the VO

Rafael Santos (Johns Hopkins University/ Dept. of Physics and Astronomy / INPE - Brazil), Jordan Raddick (Johns Hopkins University/ Dept. of Physics & Astronomy), Iranderly Fernandes (Laboratório Nacional de Astrofísica - Brazil)

There are several Web-based tools that allow users to access astronomical images and data from different surveys. Almost all are integrated with or accessible via Virtual Observatory (VO) portals. These interfaces, though powerful and flexible, are often complex and puzzling for some categories of users, specifically those who are not acquainted with the VO and the organization of their data. This includes students, amateur astronomers, and other users that just want simple answers for simple questions.

In order to provide such users with a tool that meets some of their expectations and requirements, we developed PocketVO – a simple Web-based interface to existing services such as the Sesame name resolver and image cutout services (Sloan Digital Sky Survey). Using PocketVO is extremely simple: the user is presented with a simple form to enter the object's name, and the complex Web service calls that collect and present the cutouts for the selected object in several different wavelengths are hidden from the user. For more advanced users, some other search options are presented in a non-obtrusive, intuitive way.

As part of the PocketVO development, we have evaluated some APIs and Web services that allow access to VO data services. The evaluations were done from the point of view of a programmer with just a little familiarity with the VO structure and tools. The experience that we have acquired with the evaluation and development of PocketVO will inform the development of future educational tools for VO users.

P1.19 SAI CAS: System for storage and access services of large astronomical catalogues

Sergey Koposov (Max Planck Institute for Astronomy), Oleg Bartunov (Sternberg Astronomical Institute), Sergey Karpov (Special Astrophysical Observatory), Alexander Belinksiy (Sternberg Astronomical Institute)

We present the results of further development of Sternberg Astronomical Institute Catalogue Access Services (SAI CAS) project–the VO project in Russia, which provides on-line access to the major astronomical catalogues and different services on top of them. SAI CAS is an open-source implementation of the general catalogue access service (influenced by SDSS CAS & CASjobs project), based on original algorithms and open-source software. Currently we provide the conesearch service on a set of large astronomical catalogs: USNO-A2/B1, 2MASS, UCAC-2, NOMAD, DENIS, Tycho-2, XMM source catalog and SDSS DR5. We also provide the interface which allows spatial crossmatching of any our catalog with the user's tables. The crossmatch between large catalogs uploaded in SAI CAS system is also possible. The query results could be easily loaded in other VO programs using the PLASTIC protocol enabled on our server. The interface of SAI CAS allows user to upload his tables in the separate area on the SAI CAS server and execute SQL queries on them.

P1.20 Services at VO-Paris Data Center

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We present some implementations of services developed at VO Paris Data Centre: (1) The Euro3D Client, a software implementing several existing VO standards for displaying and manipulating 3D spectroscopic datasets; (2) Image services, providing access to several collections of digitized plates.

P1.21 Taverna and Workflows in the Virtual Observatory

Nicholas Walton (IoA, University of Cambridge), Dugan Witherick (Department of Physics and Astronomy, University College London), Tom Oinn (European Bioinformatics Institute, Wellcome Trust Genome Campus, Cambridge), Kevin Benson (MSSL, University College London)

Taverna (see `http://taverna.sourceforge.net`) has been developed by the BioInformatics community – where it is now well established in use. The European Southern Observatory (ESO) has used Taverna as the basis for its Reflex workflow system. ESO aim to utilise Reflex in implementing data reduction pipelines specifically tailored for a range of their instruments on the VLT and other ESO telescopes.

This poster will discuss how AstroGrid have developed a plug-in adaptor for Taverna, thereby exposing the standard range of VO services (thus SIAP, SSAP, TAP, CEA-Common Execution Architecture) to Taverna.

Taverna is then used both as the graphical workflow builder and as the workflow enactment engine. We note how that currently the enactment engine is a client side application (Taverna 1.5) but that AstroGrid is working with the Taverna development team in enabling a server based enactment engine capability as of the Taverna 2.0 release (2008).

A number of workflows, for instance to search multiple remote data archives, return results, cross match the tables, have been implemented as Taverna workflows. The poster will show how the AstroGrid Taverna implementation is being integrated into the new AstroGrid VO Desktop.

P1.22 The search of scientific textual information in the Virtual Observatory

Oleg Bartunov (Sternberg Astronomical Institute, Moscow University), Sergey Karpov (Special Astrophysical Observatory of Russian Academy of Sciences)

We discuss the problem of incorporation of full-text search into framework of the Virtual Observatory. VO provides programmatic access to the astronomical data, usually available in tabular form from distributed network of astronomical data centers. However, there are many astronomical data available in textual form, such as scientific papeps, preprints, web pages, etc. These data usually are the data not yet available in catalogs format and it's very important to provide specialized search oriented to data about astronomical objects.

While it does not require any significant change in the Registry concept (any article may be considered as a separate resource, accessed through standard OAI-2.0 interface, superseded by the Registry), it raises some specific problems related to search queries for such resources. The search of astronomical textual information is complicated due to large diversity of object name nomenclature and terminology, which is suboptimal for usual indexing schemes. For example, 'Messier 82', 'M82' and 'M 82' refer to the same object, total it has 60 unique names in catalogues.

We describe two-stage approach which may be applied for such a task. It consists of both normalization of archived texts (conversion of different variants of the same name to standard form, like M 82 -> M82), and expansion of object name query to include all its aliases (M82 -> M82 + UGC5322 + all other 58 possible names).

We implemented it as a Registry for arXiv.org astro-ph abstracts using specially designed normalization dictionary for open-source PostgreSQL RDBMS with Tsearch2 full-text search plugin for the former task, and SIMBAD name-resolving web services – for the latter. Also, we implemented usual web form query interface to perform both full-text search and query by object name.

2. Visualisation

P2.1 A Java image contour algorithm for Herschel DP

Sara Regibo (Instituut voor Sterrenkunde, Katholieke Universiteit Leuven)

The image visualisation in the Herschel Data Processing system needed to be extended with a functionality to make contour plots for sky images, as the underlying JSky library that is currently being used, does not support this.

We developed Java code that generates contours as polygons, which can be overlayed on an image by passing them to the JSky annotation framework. The algorithm is a variation on the contour plotting algorithm of W.V. Snyder (1978) and is based on linear interpolation.

We describe the algorithm on the basis of its graphical interpretation, show some results of the contour plotting and explain briefly how the algorithm fits into the overall image visualisation framework.

The algorithm and its Java implementation can be used in a wide range of software projects, in which a performant and robust contour plotting functionality is required.

P2.2 3D Healpix-based skymaps visualization using Java

Emmanuel Joliet (ESAC), William O'Mullane (ESA), Krzysztof Gorski (JPL NASA), Anthony John Banday (MPA-Garching), Eric Hivon (IAP), Richard Carr (ESA)

HEALPix is a Hierarchical, Equal Area and iso-Latitude Pixelisation of the sphere useful for High resolution sky pixelisation to spherical coordinate transformation for data analysis and visualization.

Gaia is the ESA space astrometry cornerstone mission the main objective of which is to astrometrically and spectro-photometrically map 10e9 celestial objects (mostly in our galaxy) with unprecedented accuracy. The data used and produced by the processing tasks will be organized and stored in a central database at ESAC (Spain).

To achieve its targeted astrometric accuracy of a few tens of microarcseconds a highly structured and complex processing of this data is required. The data treatment needs a complete data analysis visualization tool to accomplish a successful mission.

The 3D Healpix-based skymaps are used as part of the interactive on(off)-line diagnostic tools as well as within the core processing. It uses the Java implementation ported API of the HEALPix software including a 3d rendering with java3d software.

We present the HEALPix Java library and give some examples of its use within Gaia processing.

P2.3 A component based astronomical visualization tool for instrument control and data pipeline

Florian Briegel (Max Planck f. Astronomie)

For various instruments developed at the Max-Planck-Institute-Heidelberg there was a need for a highly flexible display and control tool. Many display tools (ximtool, DS9, skycat,..) are available for astronomy, but all this applications are monolitic and cant be customized easily with plugins for the graphical display, and for remote access and control of the instrument and data pipepline. It was developed on top of Trolltechs Cross-Platform Rich Client Development Framework Qt, the modern middleware Internet Communications Engine (ICE) from ZeroC and the template based SOA developer framework for astronomical instrumentation(NICE

– see Abstract Juergen Berwein). The display tool is used on the Calar Alto Observatory (Spain), and it will be used for a instrument at the Wise Observatory (Israel) and for LBTs interferometer Linc-Nirvana (USA).

P2.4 Customised Cosmological Visualisations

Christopher Fluke (Swinburne University of Technology), David Barnes (Swinburne University of Technology)

Over the last decade, the volumes of observational and computationally generated cosmological datasets have grown at a rapid rate. As a complementary approach to statistical analysis (e.g. n-point correlation functions, power spectra, etc.), interactive three-dimensional visualisations are valuable for knowledge discovery – along with providing simple 'sanity checks'. However, there are challenges in producing a generic software tool that will satisfy the needs of all researchers. We have developed S2PLOT, an advanced graphics programming library, that greatly simplifies the process of developing customised three-dimensional visualisations. The resulting software tools can be used on both standard desktop displays and advanced displays (e.g. stereoscopic projection or digital domes). In this paper, we discuss how we have used custom S2PLOT visualisations as an integral component in investigating large-scale structure and dark matter halos from cosmological N-body simulations. We also describe the development of S2PLOT interactives for the Wiggle-Z dark energy survey and the Local Volume HI Survey (LVHIS), and consider the implications for integration with the Virtual Observatory.

P2.5 Data Visualization in the ESA Science Archives and ESA VO

Esther Parrilla-Endrino (European Space Astronomy Centre (ESAC))

ESA Science Archives and VO tools are designed to ensure easy handling of mission data for the Scientific Community, allowing customized searches, display of data and related meta-data and download of products.

One of the key points in the Archives is a proper data visualization of icons and postcards using the Archive's Survey Products Display Tool or some of the most common visualization engines such as VOSpec, Aladin or ds9.

Also the Archives allow the interoperability with other ESA or external Archives.

With this approach, the Archives provide a centralized way to visualize the same data using different applications depending on its characteristics.

P2.6 FITSTBLVIS - A generic Binary FITS tables visualization tool

Jeroen de Jong (European Southern Observatory)

We present a generic Binary FITS tables visualizaton tool, which is suitable for large datasets (tables with up to one million rows) and allows one to combine data from different tables in a single plot. The tool produces interactive plots based on the JFreeChart library in which the data is reduced in realtime to prevent too many datapoints to be plotted. Each plot window has zoom and scroll sliders for easily browsing through the data. Furthermore, the tool has a GUI for configuring a custom plot by selecting tables, columns and keywords from an example FITS file, providing the title, labels and plot options, and possibly adding mathematical operations on the selected columns. This configuration can be saved along with an identification of the file for which it has been created. Such saved plot configurations will be loaded automatically whenever a file which matches the identification is opened. In short, one can with this tool easily create custom plots for particular data products without programming. We mainly developed this tool to be able to visualize the

interferometric data from VLTI instruments more easily, but it can of course be used for any kind of binary FITS table data.

P2.7 GAIA 3D: Volume visualisation of data-cubes

Peter Draper (University of Durham), David Berry (University of Central Lancashire), Tim Jenness (Joint Astronomy Centre), Malcolm Currie (Rutherford Appleton Laboratory), Frossie Economou (Joint Astronomy Centre)

We are extending the Starlink GAIA application to provide integrated 3-D volume and iso-surface rendering. This will augment the already powerful data-cube handling capabilities of GAIA. The resulting system will provide a simple integrated environment for the visualisation and analysis of astronomical data with their complex file and co-ordinate formats. We illustrate the work done so far using data from the JCMT's heterodyne receiver array HARP and UKIRT's imaging spectrograph UIST.

P2.8 INTEGRAL Visualation Tool and Explorer (INVITE)

Pieter Jan Baeck (ESAC/ESA), Owen Williams (ESA/ESTEC), Peter Kretschmar (ESA/ESTEC)

The INtegral VIsualisation Tool and Explorer (INVITE) has been available as part of the (ISOC Science Data Archive) ISDA since Dec 2006. It provides an easy and convenient method of manipulating light-curves from INTEGRAL and many other instruments.

INVITE is a compact (1.5 Mbyte) programme written entirely in Java. It needs only for a Java Run time Environment (JRE) of version 1.4 or higher to be available. This means it can be launched from the ISDA and run on the client machine as a Java applet. Subsequent operations on even relatively large data-sets are rather rapid, since it then runs entirely on the client side. INVITE can also be used in a stand-alone mode to manipulate data from one or more OGIP compliant FITS light-curves.

INVITE allows the user: to simultaneously display a number of light-curves, combine light-curves from different energy bands, generate hardnessratios and to re-bin the light-curves in time. If a number of light-curves covering adjacent bands are available, these can be used to generate a 'broadband' spectrum which can be passed to XPSEC.

P2.9 MUSE data analysis and visualization software

Peter Weilbacher (Astrophysikalisches Institut Potsdam), Joris Gerssen (Astrophysikalisches Institut Potsdam), Martin Roth (Astrophysikalisches Institut Potsdam)

The Multi Unit Spectroscopic Explorer (MUSE) is a 2nd generation VLT instrument that will be operational by 2012. It will simultaneously record 90,000 contiguous spectra in a one arcmin (0.2 arcsec sampling) field of view over a wavelength range from 465 to 930nm (at an average resolution of 3000). The data reduction software is built using ESO's CPL libraries and a prototype of this pipeline is now available. To facilitate the scientific analysis of the pipeline reduced data the MUSE team has identified a set of goals that require the development of additional software. These tasks include improving the spatial resolution, 3D adaptive binning of the data and the automatic detection and characterization of faint sources as well as creating an interactive visualization tool.

P2.10 Space Walker. The cognitive visualization system with the dynamic projection of multidimensional data

Vladimir Gorokhov (Saint Petersburg Electrotechnical University), Vladimir Vitkovskiy (Special Astrophysical Observatory of RAS), Serge Komarinskiy (Special Astrophysical Observatory of RAS), Dimitri Zakharevski (Special Astrophysical Observatory of RAS)

The project of data cognitive visualization system-'Space Walker' is presented. The main issues of project are: 1. Development of procedures and methodology of work in the contemporary systems of the cognitive machine drawing, which ensure the application of these systems with the analysis of the large volume of the experimental data of the obtained in the region natural sciences, and also with monitoring of ecological, technical, social, economic and political systems. 2. Development of the philosophical aspects of the cognitive processes of cognitive machine drawing. 3. Formation of ergonomic recommendations and requirements for software of the support of making decisions and visual programming, that use the developed procedures and methodologies. 4. Resolving the fundamental problems of the use of the methodology of experimental sciences developed in phenomenology is assumed in connection with the data reduction processes. The approach to the use of methods of phenomenology proposed in the project is fundamentally new. 5.Creation of algorithms and software of the cognitive visualization of the multidimensional massifs of data. The creation of program products for the solution of the problems enumerated above in turn requires the practical mastery of the entire complex of achievements in the field of mathematical statistics, theory of illegible sets, cognitive machine drawing, cognitive psychology and, first of all, the theory of knowledge (gnosiology). Project base on the ground of possibility use already acting program software intellectual support adopted solution in task control complex system with deep a priori uncertainty.

P2.11 The Methods of Cognitive Visualization for The Astronomical Databases Analyzing Tools Development

Vladimir Vitkovskiy (Special Astrophysical Observatory), Vladimir Gorokhov (Saint-Petersburg Economy Engineering University)

The modern fundamental science brings more and more volumes of experimental data. Only the astrophysical observation archives have up to petabytes these now. The enormous data analysis is coming to a huge problem for investigators. We offer a rather natural way for resolution of this complex of difficult scientific and problems. These problems can be resolved with the help of modern information technologies, and first of all, – with the help of the cognitive computer graphics. There are two (computer) graphics: the illustrative one and the cognitive one. Appropriate the cognitive pictures not only make evident and clear the sense of complex and difficult scientific concepts, but promote, – and not so very rarely, – a birth of a new knowledge. On the basis of the cognitive graphics concept, we worked out the SW-system for visualization and analysis. It allows to train and to aggravate intuition of researcher, to raise his interest and motivation to the creative, scientific cognition, to realize process of dialogue with the very problems simultaneously. The existing sets of data of the coherent surveys of the large sections of sky in several wave ranges, offer possibilities for obtaining of new knowledge (data mining), search and discovery of rare objects, search for changeability and the like with the aid of the complex with the algorithms of pattern recognition, statistical and heuristic methods (discovery tools). Completely new scientific results can be obtained from the joint use of given, accumulated on the different instrument complexes in the course different experiments. The proposed approach permits implementation of two-dimensional projection of multidimensional data on the arbitrarily assigned by research operator plane in the multidimensional configurative (phase) space. But user, accomplishes selection of the best position of the plane of projection, relying on its intuition and cognitive means before the eyes. Having the capability to actively influence the orientation of the plane of projection in the multidimensional space, researcher is free from the preliminary considerations about the statistical or geometric structure of data, which present objects both astrophysical, social or ecological monitoring. Man directly sees on the screen of the projection of clusters or multidimensional surfaces, into which are

formed his data. And this entertainment means stimulates its intuitive understanding of the objects being investigated. This dynamic viewing it makes possible for it very to select the orientation of plane in order to have the best (in the intuitive sense) projection for further, objective statistical processing. Especially this is important with the analysis of statistical connections, factor analysis and pattern recognition. The fact that the procedure of dynamic visualization does not rest on the a priori information about nature of objects, but means and it does not introduce in the projection of the distorting influences of one or other model or another, gives the possibility to use the visualized means under the conditions of deep a priori uncertainty. This is achieved by the use of robust and nonparametric procedures of the capable of remaining operable under such conditions of deep a priori uncertainty. Algorithms of such type are capable of objectively reflecting those analytical properties of multidimensional data, which then are revealed by the traditional methods of multivariate analysis. In this case it is possible to grasp the new unexpected statistical connections and clusters in multidimensional data precisely for human operator, armed by the data by algorithm. Since, here is succeeded in connecting, that resource of intuition and nonformal experience, which is characteristic precisely of man to researcher. Let us examine working preliminary hypothesis for explaining cognitive nature of the proposed procedures taking into account the ideas of cognitive psychology about the mechanisms of consciousness.

P2.12 Visualisation of Complex Observational and Theoretical Datasets in the VO

Igor Chilingarian (Observatoire de Paris / SAI MSU), Ivan Zolotukhin (SAI MSU)

Our presentation is aimed at data centres providing access to complex observational and theoretical data and to the users of these resources. We will show how to visualise complex datasets stored in the VO enabled data archives using existing VO client software and PLASTIC, a prototype of an application messaging protocol, for interaction between archive query results and tools. We will demonstrate how to display and explore observable IFU datasets, provided within the ASPID-SR archive, using CDS Aladin, ESA VOSpec, and VO-Paris Euro3D Client. In the second part of our demonstration we will use TOPCAT for displaying results of N-body simulations of galaxy mergers available in the GalMer Horizon database. Technical details on implementation are given in a poster by Zolotukhin & Chilingarian, this conference. The 2 archives mentioned above provide implementation for a bunch of IVOA standards and protocols: SSAP, Spectrum DM, Characterisation DM, SNAP, PLASTIC, CEA.

3. Data Mining

P3.1 A Novel GUI Based Interactive Work Flow Application for Exploratory and Batch Processing of Light Curves

Evan Morikawa (Initiative in Innovative Computing at Harvard), Rahul Dave (Initiative in Innovative Computing at Harvard), Pavlos Protopapas (Initiative in Innovative Computing at Harvard), Gautham Narayan (Harvard-Smithsonian Center for Astrophysics)

Current methodologies for extracting desired data from light curves involves a complicated process, which produces results specific only for the host research project. To create a more generic environment to easily filter, correct, and clean light-curve data from a myriad of sources; we have developed an XML based work-flow application which allows for a standard, yet scalable and flexible way to handle light curve processing. Wrapped in a Python powered interactive GUI, this application offers astronomers an environment to easily experiment with various light curve filtering techniques, and apply those techniques in batch to large set of raw light curves. Since the application specializes in the processing of raw light curve data, a large agglomeration of databases from various surveys can be combined and simultaneously analyzed for data initially beyond the scope of its survey. We are initially utilizing the application to search for variable stars within the data collected by ESSENCE. By reprocessing the ESSENCE data through our work-flow application we demonstrate the potential to find variable stars from a survey initially designed to discover type Ia supernova.

P3.2 A User Interface for Semantically Oriented Data Mining of Astronomy Repositories

Brian Thomas (University of Maryland), Edward Shaya (University of Maryland)

We discuss the difficulties and solutions for providing an user friendly, but powerful interface for data mining of Astronomy repositories. We will demonstrate our current generation tool on actual data and show how it may be used to achieve a powerful semantic query and then retrieval from multiple repositories. We will also show how our tool allows for natural user-specified workflows which transform the data retrieved from repositories into a form which the user finds convenient but has still maintained the semantic and scientific integrity of the data.

URL: `http://archive.astro.umd.edu/ViperFramework`

P3.3 A User Interface to the Chandra Source Catalog

Panagoula Zografou (Smithsonian Astrophysical Observatory), David Van Stone (Smithsonian Astrophysical Observatory), Michael Tibbetts (Smithsonian Astrophysical Observatory), Peter Harbo (Smithsonian Astrophysical Observatory)

A User Interface to the Chandra Source Catalog (CSC) is under development with a first release planned in Spring 2008. The CSC contains Master Sources and Per-Observation Sources. A Master Source is characterized by properties which are determined by merging individual Per-Observation Sources. A database is being designed to support the proposed User Catalog Model which consists of a Master Source Catalog and a Per-Observation Source Catalog. The database supports multiple releases, dynamic user views, and ADQL-compatible SQL queries. A web-based application is also planned for access to the catalog. The application enables searches by either catalog release or dynamic view as well as display of Master Source properties. A user can follow links from a Master source to associated Per-Observation Sources, view source properties and images, and retrieve selected data products. This paper reviews the database and application design that supports the requirements for the first release.

P3.4 A VO based tool computing cross-identification probabilities for the 2XMM catalogue

François-Xavier Pineau (Observatoire de Strasbourg), Sebastien Derriere (Observatoire de Strasbourg), Laurent Michel (Observatoire de Strasbourg), Christian Motch (Observatoire de Strasbourg)

We present a tool developed to cross-correlate 2XMM sources with various other catalogues. Archival data are collected using VO protocols. The cross-correlation algorithm is based on a likelihood ratio (LR) technique. It takes into account local densities and estimates the expected number of spurious associations as a function of LR without resorting to Monte Carlo simulations. Groups of similar XMM fields of view are stacked to increase statistics and provide better fits to reliability functions. These informations are used to enrich qualified links between X-ray sources and possible counterparts in archival catalogues held in the XCAT-DB, one of the Survey Science Center interface to the 2XMM catalogue. These identification probabilities will be later used to develop an automated classification algorithm.

P3.5 An information system to exo-planetes data

Christian Surace (LAM), Jean Charles Meunier (LAM), Magali Deleuil (LAM)

The extend searches of exoplanets carried out over large sample of the stellar population raised new needs. A deep investigation in the nature and origin of the new planet population could be foreseen only on a well-characterized stellar population. LAM is part of the COROT exoplanete search and the SPHERE project. 2 information systems have been implemented based on the SITools framework. The talk will present the SItools framework principles and the tools developped to perform the best use out of the databases in the search of exo planets searches.

P3.6 AstroId: an astronomical archives data mining tool

Jerome Berthier (IMCCE - Observatoire de Paris), Jesus Iglesias (IMCCE - Observatoire de Paris), William Thuillot (IMCCE - Observatoire de Paris), Guy Simon (GEPI - Observatoire de Paris), Frederic Vachier (IMCCE - Observatoire de Paris)

Nowadays, numerous sky surveys that could provide a huge amount of astronomical observational data for solar system objects are still not fully analyzed. The mining of this archives requires fast and reliable processing tools in order to detect and identify solar system objects (SSO), in particular to seek for pre-discovery observations of asteroids. For this goal, we have developed a data mining tool within the Virtual Observatory framework that performs an automatic identification of the SSO present in astronomical archives.

As a first science case, we have analyzed the near-infrared sky survey DENIS. We have obtained some promising preliminary results: among the 5,206 strips of the survey (each strip being composed of 180 CCD images) we have found approximately 20,800 correlated observations of about 15,600 SSO from which 313 observations are related to some 230 NEO. Besides, we have also found 7,720 unclassified celestial objects from which a good part will likely turn out to be new SSO still unknown at present time.

P3.7 Automatic recognition of object names in literature

Christian Bonnin (CDS), Sebastien Derriere (CDS), Soizick Lesteven (CDS), Anais Oberto (CDS)

SIMBAD is a database of astronomical objects that provides (among other things) their bibliographic references in a large number of journals. Currently, these references have to be entered manually by librarians who read each paper. To cope with the increasing number of papers, CDS develops a tool to assist the librarians in their work, taking advantage of the Dictionary of Nomenclature of astronomical objects, which keeps track of object acronyms and of their origin.

The program searches for object names directly in PDF documents by comparing the words with all the formats stored in the Dictionary of Nomenclature. It also searches for variable star names based on constellation names and for a large list of usual names such as Aldebaran or the Crab. Object names found in the documents often correspond to several astronomical objects. The system retrieves all possible matches, displays them with their object type given by SIMBAD, and lets the librarian make the final choice. The bibliographic reference can then be automatically added to the object identifiers in the database. Besides, the systematic usage of the Dictionary of Nomenclature, which is updated manually, permitted to automatically check it and to detect errors and inconsistencies.

Last but not least, the program collects some additional information such as the position of the object names in the document (in the title, subtitle, abstract, table, figure caption...) and their number of occurrences. In the future, this will permit to calculate the 'weight' of an object in a reference and to provide SIMBAD users with an important new information, which will help them to find the most relevant papers in the object reference list.

The study is developed in the frame of the VO-TECH Design Study, funded by the European Commission.

P3.8 Data mining in astronomy: classification of eclipsing binaries

Oleg Malkov (Institute of Astronomy), Leonid Kalinichenko (Institute of Informatics Problems), Edouard Oblak (Observatoire de Besancon)

Data mining is a powerful tool to obtain new knowledge and make scientific discoveries. One of key problems in astronomy is the classification of astronomical objects based on their observational parameters. Main goal of the current presentation is a description of method and results of data mining application to automatic classification of eclipsing binaries.

The method is based on the data from a thousand classified systems and allows for the classification of a given system based on a set of observational parameters, even if the set is incomplete. The procedure is applied to large catalogues of eclipsing variables, including those obtained as by-products of microlensing surveys (OGLE, MACHO, ASAS-3). About 5300 systems were classified for the first time and can be used for the determination of the astrophysical parameters of their components. The procedure can be also applied to coming data from future ground-based and space (GAIA, COROT) observatories.

P3.9 Data Mining the MMT All-Sky Camera

Elizabeth Stobie (MMT Observatory), Timothy Pickering (MMT Observatory)

An all-sky camera system has been in continuous operation at the MMT Observatory since March 2005. While the system was relatively inexpensive to build (under $3,500), it has proven to be very robust and an invaluable tool for MMT staff and observers. It records images every 8.5 seconds yet is still sensitive enough to detect stars down to a visual magnitude of about 6 over a 160 degree field of view.

In this paper we describe in detail how the data from this system are acquired, analyzed, and archived. The high sensitivity and relatively fast refresh of this system makes it very well-suited to detecting transient events. The short exposure time allows subsequent frames to be subtracted with minimal residual sidereal shift. We discuss the algorithms we use to analyze difference images from this system to detect various kinds of transient events as well as cloud cover. We also discuss our attemps to derive useful stellar and sky brightness photometry from these data.

P3.10 Improved Search Techniques in Spectrum Databases

Laszlo Dobos (Eotvos University), Laszlo Dobos (Eotvos University), Tamas Budavari (The Johns Hopkins University), Istvan Csabai (Eotvos University), Geza Herczegh (Technical University of Budapest), Alex Szalay (The Johns Hopkins University)

We present the latest version of the Spectrum Services for the Virtual Observatory with improved search capabilities. Beside the already available cone search, advanced search and redshift search we introduce the region search, SkyServer search and similar spectrum search options. Region search is an integration of the VO Footprint Service and Spectrum Services where users can define arbitrary sky regions on the surface of the celestial sphere and look up all the spectra within them. Region search is based on the exact spherical geometry library of the JHU team and hierarchical triangular mesh style indexing of the spectrum databases. SkyServer search is an integration of SkyServer's CAS Jobs web service into the Spectrum Services. SQL queries resulting in a set of spectrum object IDs can be run on the SkyServer (which does not contain the spectra themselves) and Spectrum Services look up the corresponding spectra in the different versions of SDSS spectrum databases. Similar spectrum search is based on the expansion of spectra on a basis derived from principal component analysis. Users can upload their spectra which are being expanded on the basis so the first n (usually 4–6) coefficients are determined by least chi-square fitting. Based on these coefficients a k-nearest neighbor search is run using our special multidimensional database indexing technique. A new downloading interface is implemented according to the requests of the users supporting batch download of thousands of spectra in zipped archives in various formats. The new IVOA spectrum data model is fully implemented as well as the simple spectrum access protocol. For on-the-fly spectrum processing a parallelized pipeline is designed to get a significant performance gain by using multi-core servers.

P3.11 Middleware for data visualisation in VO-enabled data archives

Ivan Zolotukhin (SAI MSU), Igor Chilingarian (Observatoire de Paris/SAI MSU)

We present a middleware for visualisation and exploration of complex datasets in a VO framework, that performs interaction between data archives and existing VO client applications using PLatform for AStronomical Tools InterConnection (PLASTIC). It comprises: (1) PLASTIC-enabled Java control applet, integrated into archive web-pages and interacting with VO applications (e.g. CDS Aladin, ESA VOSpec, TOPCAT); (2) cross-browser compatible JavaScript part managing PLASTIC-aware VO Clients (launch, data manipulation) by means of Java LiveConnect. This (or similar) solution is an essential for new generation VO-enabled data archives providing access to complex observational and theoretical datasets (3D-spectroscopy, N-body simulations, etc.) through web-interface. Examples of implementation will be shown in 'focus demo' by Chilingarian & Zolotukhin. Thanks to PLASTIC capabilities it is possible to start all necessary client software with a single-click in the archive query result page in a web-browser. This simplifies the scientific usage of the VO resources and makes it easy even for users with no experience in the VO technologies.

P3.12 Pre-Processing of Data in Astronomical Data Mining Applications

Annelie Howes (Trent University), Sabine McConnell (Trent University), David Patton (Trent University), Scott Williamson (Trent University)

Much of the success of data-mining applications is determined by the pre-processing of the data. The pre-processing required for astronomical data in the application of data-mining often presents unique challenges due to the nature of such data. Issues that arise in pre-processing of astronomical data for use in data-mining includes data type, sampling needs, dimensionality reduction, transformations as well as attribute subset selection of attributes. This poster presents these issues as well as methods for both observation and simulation astronomy data.

P3.13 Time domain exploration with the Palomar-QUEST Synoptic Sky Survey

Ashish Mahabal (California Institute of Technology), S G Djorgovski (California Institute Of Technology), Andrew Drake (California Institute Of Technology), Roy Williams (California Institute Of Technology, CACR), PQ Team (California Institute Of Technology), PQ Team (Yale)

Palomar-QUEST (PQ) survey has amassed over 20 TB imaging data over the last three years. For the last several months we have been processing the PQ data in real-time. PQ is well suited for the search of transient and highly variable sources as we use four photometric passbands nearly simultaneously. Using a series of software filters we separate the flagged objects into different classes e.g. known asteroids, new asteroids, known variables etc. During a typical night when we cover about 500 sq. degrees we detect hundreds of asteroids and few to several astrophysically interesting transients. Here we will present (1) an outline of the work we have started towards classifying the transients based on prior knowledge of variables and transients, (2) our work on the quantification of the variability of blazars and quasars, and (3) the relevance for future synoptic surveys like the LSST.

4. Archives, Catalogues and Data Preservation

P4.1 A pseudo-parallel python environment for database curation

Eckhard Sutorius (Institute for Astronomy), Johann Bryant (Institute for Astronomy), Ross Collins (Institute for Astronomy), Nicholas Cross (Institute for Astronomy), Nigel Hambly (Institute for Astronomy), Mike Read (Institute for Astronomy)

The WFCAM Science Archive (WSA) holds the image and catalogue data products generated by the Wide Field Camera (WFCAM) on UKIRT. The data comprises pipeline processed multi-extension FITS files (multiframes) containing pixel/image and catalogue data. It is pipeline processed at the Cambridge Astronomical Survey Unit (CASU) and transferred to Edinburgh where the Wide Field Astronomy Unit (WFAU) processes it for ingestion into the database. Here we describe how the pipeline processed data are ingested into the database as the first stage in building a release database which will be succeded by advanced processing (source merging, seaming, quality error bit flagging etc.).

The ingestion procedure can be split into four separate tasks: # transfer from CASU to WFAU (described in a seperate poster), # creation of compressed library JPEGs, # ingest of multiframe metadata (including current astrometric calibration coefficients), # ingest of catalogue data (objects produced when source extraction is performed on a multiframe). These tasks are executed in a mixed Python/C++ environment and can be run in a simple 'parallel' modus operandi where the data are split into daily chunks and then processed on different computers creating files that can be ingested into the database immediately as they are available. Using python applications makes it easy to write routines so computers can be dedicated to a task if need be, i.e. running different tasks on different computers, or all can be used for the same task but on different datasets. This flexible way of handling the data allows the most usage of the available CPUs as the comparison with sequential processing shows.

P4.2 Catalog Description Files Using VOTables

Randall Thompson (Space Telescope Science Institute), Karen Levay (Space Telescope Science Institute), Tim Kimball (Space Telescope Science Institute), Rick White (Space Telescope Science Institute)

Making catalogs accessible to web users usually requires more information than is found in the catalogs themselves. For example, the actual database table field name may not be the best way to label the entry on a search form. We also wanted a way to store units, field definitions, range of values, examples, etc. as well as UCD and UTYPE values proposed by the Virtual Observatory (VO) community. As a result, the Multimission Archive at the Space Telescope Science Institute (MAST) creates description files for each catalog. These files contain all the additional field information needed to create help pages, generate VO web services, and make catalogs accessible via a standard HTML form. After trying various XML and CSV formats, we finally chose (perhaps unsurprisingly) VOTables. Files are updated via an HTML table form and PHP5 software using the SimpleXML extension. The poster will desribe the file format, parameters used, and the HTML forms used to update the files.

P4.3 Chandra Data Processing Relational Database Applications: Metrics to On-the-Fly Data Restoration

Douglas Morgan (Harvard-Smithsonian Center for Astrophysics), Craig S Anderson (Harvard-Smithsonian Center for Astrophysics), Joy S Nichols (Harvard-Smithsonian Center for Astrophysics)

The MySQL based relational database used by the Chandra data operations software application Telemetry

Tracker 9000 (TT9) has proven to have many useful applications beyond its initial purpose aiding data quality testing of Chandra data. We have developed a multi-tab Perl/Tk gui application with embedded MySQL functioning which functions as a front-end interface to TT9 and this application with the addition of new database tables and TT9 modules provides visibility into all aspects of data operations including processing, reprocessing, realtime data flow, and metrics. The database is easily extensible and has been used to respond to the changing needs of the Chandra mission while at the same time providing a history of Chandra data operations from the beginning of the mission. The types of data stored in the database, the software design of the operational GUI, and examples of current and potential future uses of the database will be presented.

P4.4 Chandra Source Catalog Quality Assurance

Ian Evans (Smithsonian Astrophysical Observatory), Janet Evans (Smithsonian Astrophysical Observatory), Kenny Glotfelty (Smithsonian Astrophysical Observatory), Diane Hall (Smithsonian Astrophysical Observatory), David Plummer (Smithsonian Astrophysical Observatory), Panagoula Zografou (Smithsonian Astrophysical Observatory)

The Chandra Source Catalog will be the definitive catalog of all X-ray sources detected by the Chandra X-ray Observatory. For each detected X-ray source, the catalog will include a detailed set of scalar source properties derived from all of the observations that include the source within the field of view, together with an extensive set of file-based data products that can be manipulated interactively by the catalog user.

Automated detection of data processing anomalies and assurance of data product quality is essential because of the large data volume that will be generated over a period of a few months during each catalog production run.

Quality assurance analysis is performed at the completion of each stage in catalog pipeline processing, so that any issues can be identified and corrected before they can affect downstream processing. Pipeline processing errors are detected automatically, and automated comparison of key diagnostic outputs with predefined validity criteria identifies potential data quality issues. The most common data quality issues are resolved without any human intervention.

Some data quality issues do require human interaction to correct the data products from pipeline processing. Cases where interactive review may be required are identified, assessed, and bundled together for efficient analysis and repair via a web-based graphical user interface (GUI). Pipeline processing continues automatically once the interactions are completed.

In addition to automated criteria-based quality assurance, human evaluation of the output products from a (small) random set of processing pipelines assists identification of unanticipated conditions for which automated evaluation criteria do not exist. The impact of any issues identified with this mechanism will be evaluated against the catalog science requirements to assess required corrective action.

We discuss design goals, algorithms, and implementation of the quality assurance processing that will be used during catalog construction.

P4.5 Collection and Use of Metrics at MAST

Karen Levay (Space Telescope Science Institute), Richard White (STScI/CSC), Randall Thompson (STScI/CSC)

Most archives gather and utilize a variety of metrics to measure use of the various datasets and tools. In the dawning era of the VO, we have utilized these statistics to document increased demands on our servers and the potential for heavy use via automated scripting tools. We can use the statistics to plan for hardware replacement and software optimization. We can also recognize events that signal usage/abuse that we cannot support and to subsequently work with those users to provide the data in a more efficient manner.

MAST gathers the basic statistics about data use such as gigabytes and datasets downloaded and download rates. We then look at the data volume downloaded in relationship to the available data volume. MAST also gathers information about papers that use the various datasets and the number of citations for those papers (obtained and updated from the ADS). We have mapped the coordinates of the database queries to analyze which parts of the sky are of the most interest to people at a given time. We present the methodology for gathering various metrics and some of the interesting use patterns discovered from the metrics.

P4.6 Column-oriented storage for efficient access to large tables

Mark Taylor (Bristol University), Clive Page (University of Leicester)

By use of column-oriented storage and file mapping, great improvements in efficiency over more conventional methods can be made for accessing large and very large tabular datasets. These techniques have been implemented in the STIL library, enabling their use in TOPCAT (an interactive graphical tool) and STILTS (a command-line table analysis suite). Benchmarks are presented which show certain common analysis tasks running 10–50 times faster than their MySQL equivalents. This speedup can be put to good use both on the desktop and at the data centre to bring new regimes of data exploration within practical reach.

P4.7 Common Archive Observation Model

Patrick Dowler (National Research Council Canada), Severin Gaudet (National Research Council Canada), Norm Hill (National Research Council Canada), Russell Redman (National Research Council Canada)

We present the current high level design of the CADC Common Archive Observation Model (CAOM). The purpose of this model is to standardize the core parts of every archive implementation so that a common set of software tools can be used across archives. This set of tools includes simple data access mechanisms (web pages and proxies), discovery agents, advanced query capabilities, and advanced applications.

CAOM is designed to support all current and future Virtual Observatory access mechanisms, specifically Data Access Layer (DAL) services. It bridges the low-level details of how the data are described internally and can be manipulated on-the-fly (FITS WCS) with high-level descriptions suitable for data discovery (exploratory querying), description (compatible with IVOA Characterisation DM), and delivery. Additional features such as multiple versions and proprietary access are also included.

P4.8 Embedding Form Generator in a Content Management System

Maria Delgado (European Southern Observatory), Andreas Wicenec (European Southern Observatory), Nausicaa Delmotte (European Southern Observatory)

Given the tremendous amount of data generated by ESO's telescopes and the rapid evolution of the world wide web, the ESO archive web interface needs to offer more flexible services and advanced functionalities to a growing community of users. To achieve this endeavour, a query form generator has been developed inside a Content Management System (CMS). A CMS offers the possibility of editing, managing and publishing web contents to non-technical users and to set strong security and permissions to web site administration. The form generator is going to acquire all the advantages of such a CMS. It will allow not only the creation and rendering of the query forms, but also the handling of the result pages and communication with the underlying archive database. This software is a contribution of Spain to the new ESO science archive facility.

P4.9 Making the 2XMM X-ray Catalogue

Clive Page (University of Leicester)

We desribe the creation of the 2XMM catalogue of X-ray sources derived from some 5 years of observations by the XMM-Newton observatory. This required the re-processing of the raw data from all observations since launch (except those still in their initial proprietary period), analysing the images for pount or extended sources, screning the images by eye for quality control, and constructing a catalogue of the resulting unique objects. The work was carried out by the XMM-Newton Survey Science Centre, a consortium of X-ray institutes around Europe led by the University of Leicester. The resulting catalogue has nearly 200,000 sources – the largest produced to date. The construction of the catalogue made extensive use of a Postgres database; a number of utilities were produced to convert data from database tables to FITS tables and vice-versa.

P4.10 New All Sky X-ray Image Database produced by MAXI on ISS

Mitsuhiro Kohama (JAXA (tsukuba space center)), Hitoshi Negoro (NIHON univ.), Motoko Suzuki (JAXA (tsukuba space center)), Hiroshi Tomida (JAXA (tsukuba space center)), Masaki Ishikawa (JAXA (tsukuba space center)), Masaru Matsuoka (JAXA (tsukuba space center))

The Monitor of All-sky X-ray Image (MAXI) will be attached on Japan Experiment Module(JEM/EF) on the Internatinal Space Staion in 'next year'. MAXI is an X-ray camera(0.5keV – 30keV) with a wide field of view designed to monitor active astronomical objects and the universe. MAXI can scan almost all sky with a precision almost 1 degree in the course of one orbit of the ISS (90 minutes). The observed data will be public immediately (as soon as possible) on our web-side. In this paper, we introduce the outline of public DB and precise schedule.

P4.11 Publishing Advanced Data Products in the ESO Science Archive

Remco Slijkhuis (European Southern Observatory), Nausicaa Delmotte (European Southern Observatory), Markus Dolensky (European Southern Observatory), Bruno Rino (European Southern Observatory), Charles Rité (European Southern Observatory), Piero Rosati (European Southern Observatory)

The Virtual Observatory Systems (VOS) Department at ESO has as one of its tasks the ingestion and publication of Advanced Data Products (ADPs) into a VO-compliant Science Archive. ADPs are high-level data products, provided by the astronomical community, generally consisting of fully reduced and calibrated imaging and spectroscopic data, ancillary products, catalogues etc. which enable immediate scientific exploitation.

The procedures, tools and setup used to allow easy characterisation & submission of the data to be published will be discussed.

P4.12 Report on the usage and evolution of the ESO Archive

Nausicaa Delmotte (European Southern Observatory)

Future development plans for the ESO Archive are based not only on the monitoring of its actual usage but also on the evolving needs of the astronomical community. How does the population of active archive users break down in terms of ESO and non-ESO member states? What are the most popular ESO instruments and modes in terms of archive requests? What is the distribution of archive requests by country? Which archive services are mostly used and which ones would benefit the astronomical user community? How many scientific publications based on ESO data account for archival research? Answers to those questions are meaningful indicators to assess the performance and the evolution of the ESO Archive and to characterize its user population.

P4.13 The distributed Archive for the LBC/LBT Science Demonstration Time

Riccardo Smareglia (INAF - OATs), Federico Gasparo (INAF - OATs), Patrizia Manzato (INAF - OATs), Adriano Fontana (INAF - OARoma), David Thompson (Large Binocular Telescope Observatory), Roland Gredel (Max-Planck-Institut fuer Astronomie)

The LBT Telescope is a corporation with partners in the USA, Germany and Italy. Following the successful start of the LBC blue commissioning in October 2006, the LBT Board decided to start scientific operations by opening an LBC 'Science Demonstration Time' (SDT) starting in January 2007. One critical point was the simultaneous and secure distribution of the data acquired between all partners as fast as possible. To do this the experiences at the IA2 (Italian Center for Astronomical Archive) with the TNG and LBC archives were used to develop a wide distributed archive system between 3 main Data Centers (Tucson, Trieste and Heidelberg) and an LBC Italian scientific center in Rome. Data are available to the SDT community within 24 hours of their acquisition. One more feature is the possibility to spread auxiliary metadata derived from a post-processing pipeline between all three Data Centers. This experience was very successful and will probably be used to designed a developed the LBT archive.

P4.14 The Ground-based O/IR Data Preservation Challenge at NOAO: Scaling up from Terabytes to Petabytes

Robert Smith (National Optical Astronomy Observatory), NOAO Data Products Team (National Optical Astronomy Observatory)

Large optical and IR mosaic cameras are becoming commonplace at ground-based O/IR telescope facilities. While the data flowing from these cameras pose a data reduction and analysis challenge for the PIs to extract their initial science, the large data volumes also imply significant data preservation challenges for the archive centers which are hoping to hold both the raw data and reduced data products. NOAO's current suite of two MOSAIC cameras, recently augmented by a wide-field IR imager called NEWFIRM, are already dominating our data storage and preservation resources. With the arrival of the One Degree Imager (ODI) and the Dark Energy Camera (DECam), the challenge quickly becomes one of petabyte scale. We describe our current development, testing, and operational program and our plans to scale to these data volumes.

P4.15 The JCMT Legacy Survey: The challenges of the JCMT Science Archive

Frossie Economou (Joint Astronomy Centre), Tim Jenness (Joint Astronomy Center), Antonio Chrysostomou (Joint Astronomy Center), Russell Redman (Canadian Astronomical Data Center), Brad Cavanagh (Joint Astronomy Center), David Berry (University of Central Lancashire)

he JCMT Legacy Survey (JLS) is an ambitious programme that will provide the first large-scale survey of the sub-millimetre sky. From planetary science through to cosmology, the initial 2-year campaign will be using the continuum instrument SCUBA-2 and the imaging spectrometer HARP to obtain over 100 Terabytes of raw data. We present our ongoing work to provide a Science Archive aimed at both survey and individual users for the distribution of raw data, processed data, advanced data products and VO integration.

P4.16 The New Face of the ESO Science Archive Facility

Andreas Wicenec (European Southern Observatory)

The ESO Archive Department has been working on a complete re-work of the Science Archive. This includes the front-end interfaces as well as the back-end databases and services. It also includes the creation and ingestion of advanced data products. This paper presents an overview of the back-end and front-end structures and the currently available data.

P4.17 The ST-ECF NICMOS Hubble Legacy Archive Project

Martin Kuemmel (ST-ECF), STECF-HLA group (ST-ECF)

In 2006 the Space Telescope – European Coordinating Facility (ST-ECF), together with its partners at the STScI and the CADC, started a project to build a Hubble Legacy Archive (HLA): a collection of high level Hubble data products and access tools to ease scientific analysis in age of the Virtual Observatory (VO). The ST-ECF has focussed on providing extracted spectra from slitless spectroscopic Hubble data, and NICMOS G141 grism data were chosen as a pilot project. Of the more than 5000 grism images, which are grouped into about 1000 data sets, we were able to extract more than 40000 spectra of individual objects. After a rigorous selection, about 5000 of these were included in the first data release in summer 2007. In this contribution we present a complete overview of the project. We present the methods used to automatically extract calibrated spectra from the data. The main products, the spectra, and associated deliverables such as cutout and stamp images are illustrated. The new HLA spectral archive interface is introduced and possible science projects based on the data are briefly described.

P4.18 VO-compatible Spectra Archives for Small Observatories

Petr Skoda (Astronomical Institute Academy of Sciences)

Although the VO Registry already contains hundreds of VO-accessible data resources, there are only few archives with optical spectra from ground-based telescopes. The majority of spectra available in Virtual Observatory comes from giant dedicated surveys like SDSS or archives of astronomical satellites. It is so because the design of VO-compatible data archive is an integral part of planning every large astronomical facility since the beginning and the project staff includes experienced SW developers keeping pace with current VO technologies and protocols.

Small observatories, however, have still a very low awareness of VO principles and goals and they do not see any benefit of publishing their spectra in public accessible archives. Quite often they impose unreasonably long proprietary period on their spectra or do not want to publish the spectra at all. Unfortunately those, who want to publish their spectra in VO do not usually have enough developing capacity and VO-aware SW developers.

The VO-enabled tools can increase the research efficiency by allowing an easy preview and visual comparison of a large number of spectra, without the need of tedious archive searching, downloading, transformation of various data formats and conversion to common physical units. Most evolved clients like VOSpec, SpecView or SPLAT support basic spectra analysis like continuum normalization, measurement of radial velocities and equivalent widths or identification of spectral lines.

The effective utilization of these clients requires the server supporting Simple Spectra Access Protocol (SSAP) to be installed in the institution at the close proximity of source datafiles, getting the metadata mostly from local SQL database of FITS headers. The possibility of restricted access to their own spectra only for the local staff will be welcome by many institutions, who are afraid of releasing their spectra into public use.

We present a survey of several available server applications supporting preliminary versions of SSAP and give the overview of their capabilities and particular data format requirements, stressing their strengths and deficiencies. Finally we describe a small archive used for local SSAP access of spectra secured by Ondrejov Observatory 2m telescope.

P4.19 Characterising the Infrared Space Observatory science data products

Alberto Micol (ESAVO, European Space Agency, SCI-OE), Aurelien Stebe (ESAVO, European Space Agency, SCI-OE), Pedro Osuna (ESAVO, European Space Agency, SCI-OE), Christophe Arviset (ESAVO, European Space Agency, SCI-OE)

The ESA Infrared Space Observatory (ISO) ended its mission in 1998. The so-called Post Operational Phase, during which both the quality of the scientific data and the functionality of the ISO archive were improved, ended in 2006.

Meanwhile, the International Virtual Observatory Alliance (IVOA) is coming up with a new standard to enable common characterisation of astronomical data, the Characterisation Data Model. The main aim of it is to define the high level metadata necessary to describe the physical parameter space of the observed, or otherwise simulated, astronomical data (being them images, spectra, etc.), and to allow enhanced interoperability to the astronomers.

Given the maturity of the ISO archive on one side, and the new ability to standardise onto typical characteristics of the scientific data products on the other, it has been decided, within the ESAVO effort, to apply the characterisation concepts and standards to the ISO science data. In this paper we will review such process and present how we can now map the well established ISO metadata, stored in the ISO archive databases, to the elements of the characterisation data model, via the ESAVO DMMapper.

P4.20 Optimal Merging of Point Sources Extracted from Spitzer Space Telescope Data in Multiple Infrared Passbands Versus Simple General Source Association

Russ Laher (California Institute Of Technology, Spitzer Science Center), John Fowler (California Institute Of Technology, Spitzer Science Center)

For collating point-source flux measurements derived from multiple infrared passbands of Spitzer-Space-Telescope data – e.g., channels 1–4 of the Infrared Array Camera (IRAC) and channels 1–3 of the Multiband Imaging Photometer for Spitzer (MIPS) – it is best to use the 'bandmerge' software developed at the Spitzer Science Center rather than the relatively simple method of general source association (GSA). The former method uses both source positions and positional uncertainties to form a chi-squared statistic that can be thresholded for optimal matching, while the latter method finds nearest neighbors across bands that fall within a user-specified radius of the primary source. Our assertion is supported by our study of completeness vs. reliability for the two methods, which involved MIPS-24/IRAC-1 matches in the SWIRE Chandra Deep Field South. Both methods can achieve C = 98%, but with R=92.7% for GSA vs. R=97.4% for bandmerge. Bandmerge is the clear winner of this comparison.

P4.21 Recalibrating WFCAM and VISTA Science Archives

Nicholas Cross (Institute for Astronomy, Edinburgh), Ross Collins (Institute for Astronomy, Edinburgh), Nigel Hambly (Institute for Astronomy, Edinburgh), Eckhard Sutorius (Institute for Astronomy, Edinburgh), Mike Read (Institute for Astronomy, Edinburgh), Johann Bryant (Institute for Astronomy, Edinburgh)

Over the lifetime of a survey, there is constant work to improve the calibration of the basic astrometric and photometric quantities. These improvements can make significant differences to the survey capabilities, opening up new avenues of exploration and improving the significance of already obtainable results.

While it is straightforward to apply new calibrations to new data as they are processed for the first time, it is more challenging to apply changes to large tables of previously ingested catalogues, especially if the changes are different for objects in the same image frame. For a database to maximise its usefulness, these changes must be applied to all the data, not just the new data.

Here we describe the methodology that we are using to update the WFCAM and VISTA Science Archives with calibration changes. This involves several changes to the archive schema, but we have done this in such a way that users will be unaffected. We also describe some of the calibration changes which will affect the WFCAM Science Archive in Data Release 3.

P4.22 Enhancing Science with a Hubble Legacy Archive

Walter Miller III (Space Telescope Science Institute), Brad Whitmore (Space Telescope Science Institute), Helmut Jenkner (Space Telescope Science Institute)

The Space Telescope Science Institute (STScI), in collaboration with the European Coordinating Facility (ECF) and the Canadian Astronomy Data Centre (CADC), is studying the development of an enhanced archive for the Hubble Space Telescope (HST). The primary image enhancements include: 1) making HST data VO compatible, 2) improving the science products for the legacy instruments (e.g., providing CR-rejected multidrizzled images for the WFPC2), 3) providing 'real time' access to the data (i.e., having the data online), 4) providing more extensive 'composite images' (e.g., stacked images, mosaics, ...), 5) improving absolute astrometry (i.e., from 1–2" to 0.2"), 6) adding a footprint service to make it easier to browse and download images, 7) adding a cutout service for super-fast access, 8) developing source catalogs for many datasets. Enhancements for spectral products (e.g., grism extractions) are being developed for future release. A general outline of the project will be provided, the system architecture will be described, and the numerous opportunities for applying existing software, frameworks, and standards (e.g., VO) will be noted.

P4.23 Interoperability of Atomic and Molecular Line Transitions: current status and future directions

Pedro Osuna (European Space Agency), Jesus Salgado (European Space Agency), Matteo Guainazzi (European Space Agency), Isa Barbarisi (European Space Agency)

The access to the vast collection of Atomic and Molecular Line transition databases is being homogenised by the definition of two interoperability standards: the Simple Line Access Protocol and the Atomic and Molecular Line Data Model. Using these two, well known databases like NIST, Chianti, etc. can be accessed through a single interface, and their data shared among the Astronomical community, which benefits enormously from the Interoperability Standards. Projects like ALMA are also making use of the Line Data Model and SLAP to design the access to their future Atomic and Molecular data holdings. This poster describes the current status and evolution of both standards.

P4.24 Source Lists for the Hubble Legacy Archive

Brad Whitmore (Space Telescope Science Institute), Kevin Lindsay (Space Telescope Science Institute)

The Hubble Legacy Archive (HLA), a joint project of STScI, CADC, and ST-ECF, is currently being constructed as a means of providing a higher level of HST archival data to the astronomical community.

We are currently in the Early Data Release stage of the project. In this presentation we provide a general examination of the strategy and the steps currently being taken to produce source lists for HST's Advanced Camera for Surveys (ACS) imaging data. We include both IRAF DAOPHOT- and Source Extractor- based source lists to facilitate the needs of the community in the identification of point and extended sources, respectively. These source lists are being created from drizzled-combined, astrometrically corrected ACS images. Future plans include the development of an 'All-HST-Sky' source list that will include observations for the various HST instruments.

P4.25 Testing a Service Oriented Architecture, the Hubble Legacy Archive

Lee Quick (Space Telescope Science Institute)

The advent of Service Oriented Architectures (SOA) has led to many new challenges in the realm of system testing. SOAs are commonly described as a multitude of services that need not know of their underlying programs or platforms. These services work congruously together to perform a shared goal, to provide functionality and products to the end user. Moreover, a fundamental idea of a SOA is that it allows for a heterogeneous, loosely coupled and distributed environment. The purpose of this paper is to illustrate the challenges, implementation and alternatives of testing in such an environment as it pertains to an applied SOA, the Hubble Legacy Archive or HLA.

P4.26 Indexing astronomical database tables using HTM and HEALPix

Luciano Nicastro (IASF-INAF, Bologna), Giorgio Calderone (Palermo University)

Within the MCS library project (ross.iasfbo.inaf.it/MCS/) we have implemented the fully automatic sky pixelization with both the HTM and HEALPix schema. Using a simple tool, any database table with sky coordinates columns can be easily indexed. This is achieved by using the facilities offered by the MySQL DB server (which is the only server MCS supports at the moment), i.e. triggers, views and plugins. Starting from a user supplied table (with sky coordinates) we'll show how to make it fully indexed in order to perform quick queries on rectangular and circular regions (cone) or to create an HEALPix map file. An SQL query to select objects in a cone will look like this: "SELECT * FROM MyCatalogue WHERE EntriesInCone(20, 30, 5)", where (20,30) are the coordinates of the center in degrees and 5 is the radius in arcmin. The important thing to note is that the DB manager needs to supply only a few parameters in the configuration phase, whereas the generic user does not need to know anything about the sky pixelization either for SELECT or INSERT or UPDATE queries. It also demonstrates that there is no need to extend standard SQL for astronomical queries (see ADQL). At least if MySQL is used as DB server.

5. Image Processing and Algorithms

P5.1 Image Stacking Tools for Modern Surveys

Eric Neilsen (Fermilab)

Modern imaging observation programs often collect many exposures for each area of sky observed. Although simple methods for generating a single, high quality exposure from collections of overlapping images are well understood and tools that implement them are commonplace, many modern exposure sets, such as those from the Sloan Digital Sky Survey (SDSS) and those expected from the Dark Energy Survey (DES), have complicating properties that these tools do not address optimally. These exposures may have different point spread functions, so direct co-addition or image stacking will not result in an image with either an optimal PSF or noise. They may have significantly different distortion in their mapping of pixel to celestial coordinates. There may be significant offsets between the images, such that the edge of one image falls near the center of the generated image; natural handling of edge effects is essential. If the generated image is to be used for object detection, exposures through different filters should be combined into a single image, so that objects below the detection threshold in any given filter may still be detected. We present progress on a set of tools for combining exposures, applying new and recently developed techniques to address these issues.

P5.2 An automatic method to determinate the flocculence rate of a galaxy

Jean Dumoncel (CNRS), Marine Campedel (GET / Télécom Paris), Henri Maître (GET / Télécom Paris), Anthony Baillard (IAP), Emmanuel Bertin (IAP)

We propose a new method to determine the flocculence of a galaxy image. Flocculence is characterized as a texture feature computed using a bank of Gabor filters. These filters, inspired by the human visual system, uniformly cover the spatial-frequency domain. Texture features are obtained by extracting statistics from sub-windows of the filtered images. Flocculent regions are then detected using a machine learning approach. Results are presented on the EFIGI dataset.

P5.3 Automatic data analysis for the Rapid Response Astronomy era.

Philip Evans (Leicester University), Laurence Tyler (Leicester University), Andrew Beardmore (Leicester University), Julian Osborne (Leicester University)

Rapid Reponse Astronomy – the ability to collect data on timescales of minutes after a trigger event – is a fast-growing area of astronomy, and it is important that the automatic production and dissemination of level 3 data products are able to keep pace with these developments.

We focus on the case of gamma-ray bursts (GRBs). These cosmic explosions appear as short, intense pulses of radiation which fade extremely rapidly. It is thus beneficial to optical astromers if as much information as possible from other observers can be disseminated rapidly, to guide their observing strategy. By automating the analysis of X-ray data from the Swift satellite, we are able to contribute significantly to this process.

We demonstrate the automatic production of accurate positions, corrected for uncertainties in the spacecraft pointing, and also light curves and hardness ratios which are updated every time more data arrive. We also discuss the production of spectra and spectra fits, which we will shortly be providing. We consider the benefits of these processes for astronomy in general.

P5.4 DER_SNR: A Simple & General Spectroscopic Signal-to-Noise Measurement Algorithm

Felix Stoehr (ST-ECF / ESO), Spectral Container Working Group (STScI, ESO, CADC)

The signal-to-noise-ratio (SNR) of a spectrum is a very useful quality indicator and widely used in astronomy. With the advent of large spectral databases covering many varieties of spectrographs – for example in the context of the Virtual Observatory (VO) – a need for a common algorithm to estimate the SNR arises. We present a simple, yet general and robust algorithm to compute the signal-to-noise-ratio that does not depend on additional assumptions and can therefore be (re-)computed at any time. The algorithm can be used to calculate the 'derived SNR' in the VO Spectral Data Model with the corresponding FITS keyword DER_SNR. As a first step, this DER_SNR computation will be applied to the datasets from IUE, GALEX, HUT, WUPPE, EUVE, FUSE, BEFS, TUES, HPOL and from all the spectrographs on Hubble (FOS, GHRS, NICMOS and STIS). Since it is so easy to compute we hope that other missions will follow and indicate the value of DER_SNR in their FITS headers together with the already existing instrument-specific SNR estimates.

P5.5 Detecting Galactic Clusters by Automatic Learning Techniques

Jose Carlos Cortizo (Universidad Europea de Madrid), Jose Ricardo Rizzo (Universidad Europea de Madrid), Fernando Mota (Universidad Europea de Madrid), Maria Cruz Gaya (Universidad Europea de Madrid)

Traditionally, the discovery and further classification of galactic clusters was driven by visual inspection of stellar fields, followed by the construction of H-R diagrams to disentangle the reality of the suspected cluster. In this way, the human intervention was esential in every step of the process which, on the other hand, was only useful for a single cluster at a time.

The availability of large (homogeneous and complete) all-sky surveys like 2MASS, together with exploitation of data mining techniques and high performance computing, allow us to automatize such traditional tasks, improving potentially the number of discoveries. Very recently, some groups have obtained successful results by using all-sky surveys and semi-automatic techniques. These results show that there still may be a number of galactic clusters yet undiscovered.

We are developing an automated learning process, which will be able to distinguish (or at least propose) the physical association of stars in a given field, presumably galactic clusters. This automated process first performs a search looking for possible clusters, automatically constructs H-R diagrams and then extracts several features from them, which will be those describing the possible cluster, our instances. Using information from real clusters, and processing them in the same way, we construct a classifier that learns how to distinguish a real cluster. In this work we show the first results of such automatic learning, that mines the 2MASS catalogue in the H, J, and K_s bands.

P5.6 Estimating Photometric Redshifts of Quasars

Dan Wang (National Astronomical Observatory, CAS), Yanxia Zhang (National Astronomical Observatory, CAS), Yongheng Zhao (National Astronomical Observatory, CAS)

With various algorithms successfully applied for measuring photometric redshifts of galaxies, we utilize support vector machines (SVMs), an empirical training-set method, to estimate photometric redshifts of quasars by means of five-band photometry data from Sloan Digital Sky Survey (SDSS). Using a sample of 67,491 quasars from SDSS Data Release Five (SDSS DR5), we explore the influence of free parameters of SVMs on the accuracy of photometric redshifts of quasars. SVMs is trained on two thirds of sample, and tested on the rest sample. The variance between the photometric and spectroscopic redshifts is 0.119, and

48.94%, 70.71% and 78.12% of the objects are within Δz <0.1, 0.2 and 0.3, respectively. Compared to the CZR, SVMs show their superiority.

P5.7 Imaging fidelity assessment in radio interferometry

Athol Kemball (University of Illinois at Urbana-Champaign), Athol Kemball (UIUC)

We present recent results concerning the use of modern statistical resampling methods in radio-interferometric imaging fidelity assessment. The theory of the computational statistical method is described, and examples are presented of its application in radio-interferometric imaging. Details of its computational implementation on high-performance computing systems are described.

P5.8 Mathematical algorithms for spectral analysis within the VO framework

Andrea Laruelo (ESAVO/European Space Agency), Pedro Osuna (ESAVO/European Space Agency), Jesus Salgado (ESAVO/European Space Agency), Isa Barbarisi (ESAVO/European Space Agency)

We present a series of algorithms for spectral analysis in the context of highly distributed data. These algorithms are integrated in VOSpec, the ESAVO tool for handling spectra. Analysis utilities for astronomical data within the VO framework must be ready to deal with a wide variety of data coming from different sources and at different wavelengths. For spectral analysis tools, that implies dealing with unevenly samplings and unequal ranges of definition for each spectra. Such tools must also be able to deal with grids of theoretical models, variable dimension of the parameters space, multi valuated spectra, interpolation techniques, spectral noise estimation, etc. The development of utilities capable of handling these issues is a cornerstone of the progress of the analysis of astronomical data. The presented algorithms cover a wide range of astronomical functionalities. Some examples are: -Discrete wavelet analysis allowing different mother wavelet functions like Daubechies, Symlets, Coiflets and Biortogonal spline wavelets and also different filter thresholds -Several filtering techniques from average, median smoothing to adaptive IDS smoothing(Gaussian, Lorentzian and Voight) -Arithmetic and convolution operations between spectra -Bisector and mirroring methods -Wavelength-to-velocity conversion -Best Fit tool based on a discretized version of the Levenberg-Marquardt method

P5.9 OverPlotter Utility for Herschel Data Processing

Lijun Zhang (California Institute Of Technology), Yi Mei (California Institute Of Technology), Bernhard Schulz (California Institute Of Technology)

OverPlotter Utility for Herschel Data Processing Lijun Zhang, Yi Mei, and Bernhard Schulz IPAC, California Institute of Technology 770 Wilson Ave, Pasadena, CA 91011

The OverPlotter utility is a GUI tool written in Java to support interactive data processing and analysis for the Herschel Space Observatory within the framework of the Herschel Common Science System (HCSS)[1]. In the same way as TablePlotter[2], the OverPlotter can be invoked under DataInspector[3] by right clicking a mouse button over any user selected Dataset[1]. It overlays a scatter plot similar to TablePlotter's on top of a user selected existing TablePlotter or OverPlotter window. If there is no existing TablePlotter available, the OverPlotter will invoke a TablePlotter window first. Each such scatter plot from either TablePlotter or OverPlotter, we call a layer. The tool allows to over-plot unlimited layers (could be constrained by computer memory). A layer selector allows users to activate an individual layer or all the layers. When an individual layer is activated, users can change display style, zoom in/out, navigate the plot, select/hide data, and extract data, as in a TablePlotter plot. Users can also select data color and layer name for each individual layer. When all layers are selected, OverPlotter can navigate and select/hide all layers' data simultaneously. The OverPlotter enables easy visual data comparison among different columns in the same dataset and different datasets. Presentation images can be easily created by adding annotations, labeling layers and setting colors. The tool will be very helpful especially in the early phases of Herschel data analysis, when a quick access to contents of data products is important.

Footnotes [1]. Wieprecht, E., Brumfit et al., The HERSCHEL/PACS Common Software System as Data Reduction System, Vol. 314 Astronomical Data Analysis Software and Systems XIII, page 376. [2]. Lijun Zhang and Bernhard Schulz, The TableViewer Utility, Vol. 351 Astronomical Data Analysis Software and Systems XV, page 89. [3]. DatasetInsepector is a framework defined in herschel.ia.dataset.gui. For more information, please refer to HCSS javaDoc.

P5.10 Photometric Redshift Estimation on SDSS Data Using Random Forests

Samuel Carliles (Johns Hopkins University/ Dept. of Physics & Astronomy), Tamás Budavári (Johns Hopkins University/ Dept. of Physics & Astronomy), Carey Priebe (Johns Hopkins University/ Dept. of Applied Mathematics and Statistics), Alexander Szalay (Johns Hopkins University/ Dept. of Physics & Astronomy)

Given multiband photometric data we estimate galaxy redshifts. We consider a data set consisting of roughly 400,000 primary galaxies from the SDSS DR5 with complete magnitude measurements and with spectroscopic redshift estimates. Our approach is to employ a random forest trained with color features and spectroscopic redshifts drawn from a random subset of 100,000 of these objects to yield a mapping from color space to redshift space such that the difference between the resulting estimate and the spectroscopic redshift is small. The results of our novel methodology on our data yield very tight RMS scatter in the estimates limited by photometric errors. Additionally, this methodology yields an error distribution that is very close to Gaussian, and can be parameterized to give reliable confidence intervals for each individual estimate, in contrast to the non-Gaussian error distribution of most other photometric redshift techniques.

P5.11 The Application of KD-tree in Astronomy

Dan Gao (National Astronomical Observatory, CAS), Yanxia Zhang (National Astronomical Observatory, CAS), Yongheng Zhao (National Astronomical Observatory, CAS)

The basic idea of the KD-tree algorithm is to recursively partition a point set P by hyperplanes, and to store the obtained partitioning in a binary tree. Due to its immense popularity, many applications in astronomy have been implemented. The algorithm can been used to solve a near neighbor problem for cross-identification of huge catalogs and realize the classification of astronomical objects. Since KD-tree can speed up query and partition spaces, some approaches based on it have been applied for photometric redshift measurement. We give the case studies of KD-tree in astronomy to show its importance and performance.

6. Object Detection and Characterisation

P6.1 Astrophysical parameter estimation for Gaia using machine learning algorithms

Carola Tiede (Max-Planck Institute for Astronomy), Kester Smith (Max-Planck Institute for Astronomy), Coryn Bailer-Jones (Max-Planck Institute for Astronomy)

Gaia is the next astrometric mission from ESA and will measure objects up to a magnitude of about V=20. Depending on the kind of object (which will be determined automatically because Gaia does not hold an input catalogue), the specific astrophysical parameters will be estimated. The General Stellar Parametrizer (GSP-phot) estimates the astrophysical parameters based on low-dispersion photometric spectra and parallax information for single stars. We show the results of machine learning algorithms trained on simulated data and further developments of the core algorithms which improve the accuracy of the estimated astrophysical parameters.

P6.2 Automatic detection of transient phenomena with 'fish eye' cameras

Alvaro Lopez Garcia (Astronomical Observatory, Valencia University)

Detection of transient phenomena is of great interest in many astronomical projects. The final purpose is to obtain robust filters to detect automatically meteor traces on CCD frames obtained with 'fish eye' cameras.

Present work is based on the analysis of this kind of frames obtained at OAUV and other observatories. Algorithms and codes are based on the previous experience of the author in minor planets astrometry with CCD images from 2001 to now.

Peculiar algorithms have been developed for several kinds of images. Visual Basic platform is used. 'Masks' or 'filters' are not applied and algorithms are original, robust and fast.

Quality of process is analyzed in different contexts and conditions and the results are discussed. This work can be applied to automatic meteor detection with different equipments as the algorithms need only small changes and adaptations.

P6.3 Classification of discrete sources for the Gaia mission

Kester Smith (MPIA), Carola Tiede (MPIA, Heidelberg), Coryn Bailer Jones (MPIA Heidelberg)

Gaia is the next generation astrometric mission from ESA, due to launch in 2011. It will survey the entire sky down to a magnitude of approximately V=20, detecting about one billion stars, or about one percent of the Galactic stellar population. Together with the stellar sample, several million galaxies, perhaps half a million quasars and many solar system objects will also be detected. No input catalogue will be used, so automated classification of detected sources is a key part of the data processing procedure. This classification will largely rely on low-dispersion spectra, together with the astrometric information. Here, we describe progress on the Discrete source classifier (DSC), the main classification algorithm, which is being developed at MPIA.

P6.4 Discrimination of Point Sources using Radial Basis Function network and Random Forest

Yanxia Zhang (National Astronomical Observatory, CAS), Yongheng Zhao (National Astronomical Observatory, CAS), Hongwen Zheng (Institute of Mathematics and Physics, North China Electric Power University)

Selecting nonrepeat photometric objects (41,359 stars and 43,010 quasars) from the Second Data Release of the sloan digital sky survey (SDSS) , we apply Radial Basis Function (RBF) network and Random Forest to separate quasars from stars. RBF network implements a normalized Gaussian radial basis function network. It uses the k-means clustering algorithm to provide the basis functions and learns a linear regression (numeric class problems) on top of that. Random forests are a combination of tree predictors such that each tree depends on the values of a random vector sampled independently and with the same distribution for all trees in the forest. The experimental results show that the accuracy of RBF network and Random Forest adds up to 93.71% and 96.98%, respectively. Apparently these two methods are applicable and effective to classify quasars from stars. They may also be used to solve other classification problems faced in astronomy.

P6.5 Faint compact object detection in wide field interferometric radio images using a hybrid method based on local thresholding and wavelet decomposition.

Marta Peracaula (Universitat de Girona), Jordi Freixenet (Universitat de Girona), Joan Martí (Universitat de Girona), Josep Martí (Universidad de Jaén), Josep Maria Paredes (Universitat de Barcelona)

Automated detection of compact objects in wide field images has classically been produced using thresholding techniques based on local noise estimation . More recently Multiscale Vision Models that use wavelet decomposition have been proposed for the same aim. We propose a hybrid method where both techniques are used at different stages: In a first step bright sources are detected using classical local tresholding and a residual image that does not contain them is produced. In a second step wavelet decomposition is applied to the residual image in order to detect faint compact objects. We show the obtained results using a wide field radio map of the Cygnus OB2 region obtained at 49 cm with the GMRT interferometer and compare them with the published catalogue produced from this image.

P6.6 Galaxy Structural Parameters in Source Extractor

Benne Holwerda (Space Telescope Science Institute)

Over the last decade, Concentration, Asymmetry and Smoothness (CAS), as well as the M20 and GINI parameters have become popular to automatically classify distant galaxies in images. Ellipticals, spirals and irregular galaxies all appear to occupy different regions of this parameter space. At the same time, the source extractor program has become the mainstay to produce object catalogs from large image surveys.

A logical next step would be to incorporate the structural parameters into the source extractor software. There are however several problems that arise: 1) the CAS parameters are fits to the images and source extractor eschews fits in the interest of speed, 2) the definition of the structural parameters changed over time.

Now that there are clear definition of the structural parameters, we have incorporated computed versions in the source extractor code. The fitted CAS parameters are available for the GOODS-N/S fields and we compare our computed structural parameters to those found by the previous fits.

Our goal is to expand the source structure information in source extractor catalogs in order to improve automatic identification of sources, specifically of distant galaxies. We discuss the accuracy of the structural parameters, the performance reduction for source extractor and possible future uses.

P6.7 LSB galaxies detection using Markovian segmentation on astronomical images

Benjamin Perret (LSIIT), Bernd Vollmer (Centre de données astronomiques de Strasbourg), François Bonnarel (Centre de données astronomiques de Strasbourg), Mireille Louys (LSIIT, Université Louis Pasteur, Strasbourg), Sébastien Lefèvre (LSIIT, Université Louis Pasteur, Strasbourg), Christophe Collet (LSIIT, Université Louis Pasteur, Strasbourg)

We have designed a new technique for the detection of Low Surface Brightness galaxies based on a new algorithm for local background/source separation using Markovian analysis. This method helps to estimate smooth local variations of the background and therefore allow for determining source candidates as faint as LSB galaxies. For each source an average density profile is computed, the shape of which can help to sort out stars and bright objects. A list of LSB candidates is provided, for which position, profile and surface brightness are examined thoroughly. The results are very promising. This approach has been compared to the Sextractor source detection tool and to a previous original analysis by S. Sabatini and coll. on the same INT image dataset of the Virgo Cluster. Detection rate, source selection criteria and calculation loop improvements are discussed. Another approach based on morphological operators was also tested and is described here too. REFERENCES: S. Sabatini, J. Davies, R. Scaramella, R. Smith, M. Baes, S. M. Linder, S. Roberts,and V. Testa. The dwarf low surface brightness galaxy population of the virgo cluster i. the faint-end-slope of the luminosity function. Mon.Not.Roy.Astron.Soc., 341 :981, 2003.

P6.8 The Chandra Level 3 Master Source Pipeline: Automated Source Correlation from Heterogeneous Observations

Roger Hain (Harvard-Smithsonian Center for Astrophysics), Ian Evans (Harvard-Smithsonian Center for Astrophysics), Janet Evans (Harvard-Smithsonian Center for Astrophysics), Kenny Glotfelty (Harvard-Smithsonian Center for Astrophysics)

The Chandra X-ray Center's Level 3 source catalog seeks to automatically detect sources and compute their properties. Since Chandra is a pointed mission, and not a sky survey, different sky regions are observed for a different number of times at varying orientations, resolutions, and other heterogeneous conditions. While this provides an opportunity to collect data from a potentially large number of observing passes, it also creates challenges in determining the best way to combine different detection results for the best characterization of the detected sources.

The Chandra Level 3 Master Source Pipeline correlates data from multiple observations by updating existing cataloged source information with new data from the same sky region as they becomes available. This process sometimes leads to relatively straightforward conclusions, such as when single sources from two observations are similar in size and position. Other observation results require more logic to combine, such as one observation finding a single, large source and another identifying multiple, smaller sources at the same position.

We present real and simulated examples of different overlapping source detections processed in the current version of the Level 3 Master Source Pipeline. We explain how they are resolved into entries in the master source database, and examine the challenges of computing source properties for the same source detected multiple times. Future enhancements are also discussed.

P6.9 The Development and Use of a Background Map for the Chandra Source Catalog

Michael McCollough (Harvard-Smithsonian Center for Astrophysics), Arnold Rots (Harvard-Smithsonian Center for Astrophysics)

Early in the development of the Chandra Source Catalog (CSC) it was recognized that a background map was

necessary to perform critical CSC tasks such as source detection, photometry, and source characterization. We present a discussion of how such maps can be created directly from the Chandra data.

The background maps for Chandra ACIS data consist of two components. One is a high spatial frequency component due to read-out streaks and the other is a low spatial frequency component. The discussion of the algorithm used for the high frequency maps has been covered in McCollough & Rots (2005). Here we focus on generating the low spatial frequency maps and on combining them with the high frequency ones to produce the final background maps. We present source detection results with and without use of background maps which illustrates the reduction in false source detections. We also discuss how well the background maps describe the 'true' background of the Chandra ACIS data and what future development might be necessary.

Finally, we turn to generating similar background maps for Chandra HRC data. These are dominated by the low spatial frequency maps for the HRC since this detector does not suffer from the read-out streak problem found in Chandra ACIS data.

This work is supported by NASA contract NAS8–03060 (CXC).

7. Data Reduction and Pipelines

P7.1 JCMT Science Archive: Advanced Heterodyne Data Products Pipeline

Tim Jenness (Joint Astronomy Centre), Brad Cavanagh (Joint Astronomy Centre), David Berry (University of Central Lancashire), Frossie Economou (Joint Astronomy Centre)

The JCMT Science Archive will contain reduced and calibrated data products from the ACSIS/HARP and SCUBA-2 instruments on JCMT. One of the goals is to generate clump catalogues, line catalogues and other advanced data prodcuts from these submillimetre data. This poster describes the data reduction pipeline that will take calibrated data cubes and generate the advanced data products.

P7.2 A SPITZER IRS Pipeline for General Users

Robert Narron (California Institute Of Technology), Sergio Fajardo-Acosta (California Institute Of Technology), David Ardila (California Institute Of Technology), Russ Laher (California Institute Of Technology)

An effort is underway to make the SPITZER InfraRed Spectrograph (IRS) data processing pipeline available for use by astronomers worldwide, i.e. outside of the operational environment of the SPITZER Science Center (SSC). This will allow users to download the raw data files from the SPITZER archive and reprocess them with customized calibration files, updated operational parameters, and/or a modified list of processing steps. The pipeline will create all standard BCD and post-BCD products, plus additional intermediate products. It will be will be made up of newly developed Perl and csh executive scripts, plus the executable modules currently used in operations (no source). The scripts are being designed for ease of use and to facilitate user-customizable modification. The systems targeted for support are Mac OS X, Linux, Solaris, and perhaps Windows. This paper describes the various components of the pipeline and examples of their use.

P7.3 ALMA Pipeline Heuristics

John Lightfoot (U.K.A.T.C.), Frederic Boone (LERMA), Friedrich Wyrowski (MPIfR), Dirk Mud-ers (MPIfR), George Kosugi (NAOJ), Tak Tsutsumi (NRAO), Christine Wilson (McMaster U), Lindsey Davis (NRAO), Debra Shepherd (NRAO)

The ALMA Pipeline Heuristics system is being developed to automatically reduce data taken with the standard observing modes. The goals are to make ALMA user-friendly to astronomers who are not expert in radio interferometry and to provide reduced results of publishable quality. The reduction sequence will continue to develop as experience is gained at the telescope, so it is important that the system has a framework and interface that are flexible and easy to use.

Observing modes to be handled include single field interferometry, mosaics, single dish 'on the fly' maps, and combinations of these. The data will be produced by the main ALMA array, the Alma Compact Array, and single dish antennas.

Reduction of interferometric data is currently done in 5 main stages; flag raw data, first calibration, flag calibrated data, second calibration, produce images. The reduction process is logged to a collection of html files that can be examined using a standard browser. The reduction is performed by a Python script and classes bound to the CASA/AIPS++ libraries.

The system recently underwent its 4th user test, in the light of which the Python code has been refactored to provide new flagging, reduction and display methods. The system framework has also been changed to make it easier to add new methods in the future.

Reduction of single-dish data is performed using the ATNF Spectral Analysis Package (ASAP). Robust spectral baseline subtraction is achieved by using a linefinder class in ASAP to identify lines in each spectrum, then by analyzing the spatial extent, continuity and persistence of each spectral feature to establish which features are 'real'. Baseline characteristics are determined using a major component analysis in Fourier space.

This poster describes the reduction path and algorithms used, recent test results, and the path for future development.

P7.4 An optimized pipeline for LBC@LBT

Cristian De Santis (INAF-Osservatorio Astronomico di Roma), A. Fontana (INAF-Osservatorio Astronomico di Roma)

We present an overview of a new pipeline for the processing of large field images obtained with the Large Binocular Camera at LBT. The pipeline provides high quality, coadded images of the LBC data, and includes specialized, original algorithms for automatic detection of defects, satllite tracks and other instrumental footprints.

P7.5 CLIP: Bridging Pipelines to Instrument Control Software

Pascal Ballester (European Southern Observatory), Peter Biereichel (European Southern Observatory), Andreas Kaufer (European Southern Observatory), Mario Kiekebusch (European Southern Observatory), Henning Lorch (European Southern Observatory)

As astronomical instruments become more complex, there is a growing need for more comprehensive data processing to be performed directly by the instrument control software. For this purpose the Common Library for Image Processing (CLIP) has been developed, as a flexible and scalable framework to provide pipeline data processing capabilities for the instrument acquisition process. The CLIP consists of a) interfaces to access the ESO Common Pipeline Library (CPL), b) a library to extend the CPL by more instrument-related image processing tasks, c) a standard architecture for the integration of instrument specific functionality, online processing and real-time display, d) a set of high level scripting commands that simplify the use of the image processing routines from the instrument templates. This paper provides an overview of the design of the CLIP and how it copes with the constraints and requirements of the second generation instruments at the ESO Very Large Telescope.

P7.6 Data Reduction and Handling for SPHERE

Alexey Pavlov (Max-Planck Institute for Astronomy), Markus Feldt (Max-Planck Institute for Astronomy)

We present the Data Reduction and Handling (DRH) software being developed for the SPHERE instrument. SPHERE is a second-generation instrument, designed and optimized for the purpose of direct imaging of extrasolar planets. Technical tolerances are the tightest ever for an instrument installed at the VLT, and SPHERE demands a rather unique DRH software package to accompany the data from the state of observation preparation to the analysis and search for planetary signals. The reduction process at the conceptual level is described and the critical issues related to above characteristics are addressed. The DRH system will be fully integrated in the framework of the ESO VLT system and it will use ESO Common Pipeline Library.

P7.7 Enzo Services via NESSSI

Richard Wagner (University of California, San Diego), Michael Norman (University of California, San Diego), Roy Williams (California Institute Of Technology, CACR)

We will describe the design of the Enzo Data Analysis Services, which allow users to perform predefined analysis operations on data generated by the AMR cosmology code Enzo. These services are a continuation of our work in building the LCA Theory SkyNode, which contains a catalog of simulated galaxy clusters from the Simulated Cluster Archive (SCA). The design of the Data Analysis Services is intended to mimic the object identification and analysis paradigm used for observational data as much as possible. Using the SkyNode, users can identify clusters by properties such as mass, redshift, or virial radius, and retrieve the corresponding object IDs. The object IDs are in turn passed to the analysis service, which handles the data. This way, users are only aware of the object IDs, analysis parameters, and results, and are not required to download software or deal with the simulation data. The Enzo Data Analysis Services have been deployed using the NVO Extensible, Scalable, Secure Service Infrastructure (NESSSI) and are accessible using a scriptable Python client, or a simple web form. Two services are will be available: a projection tool; and a radial profiler. These services are stepping stones to future services, and, it is hoped, will serve as models for other providers of theory data.

P7.8 EURECA Software

Reiner Rohlfs (INTEGRAL Science Data Centre), Javier Bussons (IFCA Instituto de Física de Cantabria), Jan van der Kuur (SRON Netherlands Institute for Space Research)

EURECA (EURopEan Calorimeter Array) is a project to develop a fully functional instrument based on transition edge sensors (TES). It shall demonstrate technical readiness for a detector, which can be used in the X-ray missions of the next years, like XEUS and EDGE. To process and to analyze the data of this EURECA instrument, software has to be developed in parallel. A tailored software is required to reach the goal of the project: An energy resolution of 1 eV at 1 KeV. On the one hand the software has to be flexible and modular to test several algorithms on the other hand it should be a straight forward pipeline system to analyze the same data set with different parameters and compare the results. Furthermore display tools to display scientific raw data, housekeeping data and the results of the analysis are required. These display tools will be used for quick look analysis as well as during off-line analysis. The produced amount of data can be up to 10 MByte per second, depending on the mode of the instrument.

P7.9 Gaia Variability Processing

Mathias Beck (ISDC)

An international consortium of some 350 active members in 15 European countries is in charge of the on ground data processing for Gaia, a major ESA astrometry mission to be launched in 2011. Within this consortium 8 coordination units (CU) have been established. Each CU has the task to develop the software needed for the part of the data processing corresponding to their respective area of expertise. The actual data processing will be carried out by 6 Data Processing Centres (DPC) spread across Europe.

The DPC for the variability processing is the ISDC being part of the Astronomical Observatory of the University of Geneva, Switzerland. The Geneva Observatory is at the same time heading the CU7 for the development effort to process the light curves from variable celestial objects.

We will briefly highlight the chosen development approach which inherits both from eXtreme Programming as well as established European Space Standards. First results of the functional analysis will be shown and the initial design of key elements of the variability processing system will be presented.

P7.10 GALEX Far and Near UV Photometry using optical priors

Antoine Llebaria (Lab. Astro. Marseille (CNRS)), Mireille Guillaume (Institut Fresnel), Agneszka Pollo (Lab. Astro. Marseille (CNRS)), Stephan Arnouts (CFHT)

Photometry of crowded fields is a old thema of astronomical image processing. Large space surveys in the UV confronts us with new challenges due to the low resolution, extended point spread function (poorly know), low counting rates, etc. Due to the morphological similitude of these UV images to their optical counterparts we can apply the bayesian approach using the visible data (catalog and image) as the starting reference for the UV analysis in the different channels. However there is not a straightforward path leading from the basic ideas to the practical implementation.

Launched in 2005 the GALEX mission of NASA, is collecting an unprecedent set of astronomical UV data in the far (135–175 nm) and the near (170–275 nm) UV range. The telescope observes the full sky in a continuous automatic scan. Knowing the attitude data, local images are simultaneously extracted and corrected for smearing and instrumental effects. Final UV images show, by far, a lower resolution than their visible counterpart leading blends, ambiguities and miss-identifications of the astronomical sources.

The original procedure (Gillaume et al.) to resolve the blended objects in the far and the near UV using the information available from existing, well resolved catalogs in the visible band. We assume that all UV objects show a visible counterpart, however the opposit is not always true (in fact it is what we are looking for!). Obviously for some of them the global form and center will evolve with the wavelength bandpass. But here we are dealing mostly with 'compact' objects enlarged by the UV instrumental point spread function or PSF, therefore the coordinates hypothesis remains valid (in most of GALEX fields the spatial extension of large objects is limited relatively to the PSF extension).. One important point must be emphasized here: astronomical objects show a large dynamical range (the flux ratio between two objects can exceed 1000 in the same field) therefore the PSF accuracy in flux and position are crucial parameters for the full process. Note that global fluxes are measured in magnitudes (it is a logarithmic flux scale defined by -2.5 log10(f/f0) where f0 is the reference flux of magnitude 0). The original point in our procedure is the bayesian approach under the Poisson noise assumption. The solution is reached with a EM algorithm.

The photometric performance has been determined by inserting randomly a large set of pseudo-stars on the original UV images and mesuring the whole as original images. These star-like objects were built with the PSF deduced from the original UV field itself. This method allows us to determine the error of magnitude vs. magnitude relationship as well as the operational range of magnitudes. This study shows that photometric performance depends on: 1) PSF accuracy, 2) background accuracy, 3) position accuracy and 4) priors accuracy.

Another key question is the number of objects retained from the optical catalog. As it has been observed, even if a moderate excess of false priors does not induce meaningful errors, it can overload the process and when too excessive it can modify the photometry of faint sources. That's why for the far UV we retain only optical sources with a meaningful near UV flux.

P7.11 Ground Segment data processing for the SuperAGILE instrument

Francesco Lazzarotto (IASF - INAF Roma), Ettore Del Monte (IASF - INAF Roma), Luigi Pacciani (IASF - INAF Roma), Immacolata Donnarumma (IASF - INAF Roma), Yuri Evangelista (IASF - INAF Roma)

The SuperAGILE instrument is a X-ray detector for Astrophysics measurement, part of the Italian AGILE satellite, launched the 23/04/2007 from India. SuperAGILE is aimed to study the sky in the 20 − 55 KeV energy band and can detect sources with good imaging, spectral and timing capabilities. The data processing scientific software performing at the AGILE Ground Segment is divided in modules, grouped in a processing pipeline named SASOA. The processing steps are data reduction, photonlist building, sources extraction and single source refined analysis.

P7.12 Performance on Ground Data Processing Systems of MAXI on ISS

Hitoshi Negoro (Department of Physics, CST, Nihon University), Hiroki Saito (Department of Physics, CST, Nihon University), Tomonori Takahashi (Department of Physics, CST, Nihon University), Mitsuhiro Kohama (JAXA/TSKC, University of Tokyo), Hiroshi Tomida (JAXA/TSKC)

MAXI, Monitor of All-sky X-ray Image (`http://www-maxi.tksc.jaxa.jp`), is an all-sky X-ray monitor, and the first astronomical observatory on the International Space Station, ISS (also see, Kohama et al. on this conference). One of the goals of the MAXI mission is discoveries of unknown X-ray transient objects, such as X-ray novae, as fast as possible. Each X-ray photon event downloaded from the ISS is stored into a PostgreSQL database, and simultaneously processed to find an X-ray flare/burst by a nova search system in a few seconds. The database is the first photon event database, and will have more than 10^{10} records through the mission life (more than 2 years). Thanks to high performance of the DBMS, it takes about 5 min to produce X-ray event files for about 1,000 objects from 1 day data (10^7 records). This easily enables us to provide new data to the world every day or every orbital revolution. In the nova search system, time variability is investigated for each celestial pixel with the HEALPix on various timescales. Performance on this large database and the nova search system will be present.

P7.13 PLANCK LFI Level 1 Processing During Operations

Nicolas Morisset (Integral Science Data Centre), Reiner Rohlfs (Integral Science Data Centre), Marc Türler (Integral Science Data Centre), Marco Frailis (INAF-OATs), Andrea Zacchei (INAF-OATs), Samuele Galeotta (INAF-OATs)

The PLANCK satellite with two on-board instruments, a Low Frequency Instrument (LFI) and a High Frequency Instrument (HFI) is foreseen to be launched not before July 2008 with Ariane 5. The Data Processing Centre (DPC) in Trieste, Italy for LFI is responsible for processing the PLANCK LFI data. The Integral Science Data Centre (ISDC) in Switzerland is responsible for developing/installing and maintaining the software for the LFI Level 1 data processing. We present here the software for the LFI Level 1 pipeline. The main tasks of the Level 1 processing are to retrieve the daily available scientific and housekeeping (HK) data consolidated of the LFI instrument, the Sorption Cooler and the 4k Cooler from MOC (Mission Operation Centre in Darmstadt); to sort them by time and by type (detector, observing mode, etc...); to extract the spacecraft attitude information from auxiliary files; to flag the data according to several criteria; and to archive the resulting Time Ordered Information (TOI), which will then be used to produce maps of the sky in different spectral bands. In addition, the ISDC also developed software tools to display and perform a quick analysis of the data. The TOI data generated by the level 1 pipeline are the input for the more scientific LFI level 2 processing. The TOI are first stored in FITS format and so ingested into the Data Management Component (DMC) system, which is the interface to the LFI DPC database.

P7.14 Production of Previews and Advanced Data Products for the ESO Science Archive

Charles Rite (European Southern Observatory), Nausicaa Delmotte (European Southern Observatory), Piero Rosati (European Southern Observatory), Remco Slijkhuis (European Southern Observatory), Fabien Chereau (European Southern Observatory), J.C. Malapert (European Southern Observatory)

This poster presents the workflow of a program produced by the VO System Department/Advanced Data Products group in order to provide the ESO Science Archive Facility with image previews and advanced data products. The main goal is to provide the clients of the ESO Science Archive Facility with the possiblity of viewing the pre-processed images,associated with instruments like WFI,ISAAC,SOFI before actually retrieving the data for full processing. The image processing is done by using the ESO/MVM image reduction pipeline developed at ESO. The output produced by the software are full FITS files, for Advanced Data Products and compressed FITS files also converted to JPEG format. The output is suitable to be shown in the ESO Science Archive Query Form, and also to be viewed with browsers as Stellarium/VirGO.

P7.15 Pulsar Data Reduction using Graphics Processors

Joe Brandt (National Radio Astronomy Observatory, Greenbank)

Processing pulsar data is a challenge due to the volume of data and the high number of floating point operations required.

The demand for realistic 3-D rendering in computer games has created a multi-billion Euro per year computer game industry. The demands on hardware for game simulation and high-speed rendering of complex scenery has inspired vendors like Nvidia and ATI to develop graphics processor units (GPU) which can sustain several hundred giga-floating point operations per second. These commodity 3-D graphics cards are currently available at low cost (under 1 pound/GFLOP), and can be used for non-graphical general purpose processing. This poster will present some of the work being performed at the National Radio Astronomy Observatory investigating the use of these systems to accelerate the processing of pulsar data.

P7.16 Real-time Transient Classification and Broadcast Pipeline

Dan Starr (UC Berkeley), Josh Bloom (UC Berkeley), Nat Butler (UC Berkeley)

The Transients Classification Pipeline (TCP) is a Berkeley-led project which federates data-streams from multiple surveys and observatories, classifies with machine learning and astronomer-defined science priors, and broadcasts sources of interest to various science clients (using the VOEvent protocol). The TCP is a production-level project, being developed to handle several upcoming data torrents (e.g. from the Palomar Transient Project), and should be scalable to LSST volumes.

P7.17 The Herschel Data Processing System — getting ready for the Launch of Herschel

Stephan Ott (ESA/ESTEC)

The Herschel Space Observatory is the fourth cornerstone mission in the ESA science programme. It will perform photometry and spectroscopy in approximately the 57–670 micron range. It will have a radiatively cooled 3.5m diameter telescope, and a science payload complement of three instruments (HIFI, PACS and SPIRE) housed inside a superfluid helium cryostat. Herschel will be operated as an observatory facility offering at least three years of routine observations, with observing time available on a competitive basis to the whole astronomical community. Herschel is being implemented together with the Planck mission as a single programme and sharing a common Ariane 5 launcher. The launch towards the operational orbit around L2 is planned for July 2008.

The development of the Herschel Data Processing System started a few years ago to support the data analysis for Instrument Level Tests. To fulfil the expectations of the astronomical community, additional resources were made available to implement a freely distributable user-friendly Data Processing System capable to interactively and automatically reduce the data at different processing levels. The Herschel Data Processing System is jointly developed by ESA, the PI teams and the NHSC. The software is coded in Java and Jython.

We will summarise the current state of the Herschel Data Processing System, and show some of its tools used for the data analysis of the Instrument Level tests.

We will outline our vision for the higher level interactive tools, and the level of the automatically generated pipeline data products.

In addition we will present our plans for workshops to introduce the Herschel Data Processing System to the astronomical community.

P7.18 The NOAO NEWFIRM Pipeline

Robert Swaters (University of Maryland), Francisco Valdes (National Optical Astronomy Observatory), derec scott (National Optical Astronomy Observatory), Mark Dickinson (National Optical Astronomy Observatory)

The data taken with the NOAO Extremely Wide-Field Infrared Imager (NEWFIRM) is processed by the NOAO NEWFIRM pipeline. This pipeline consists of two distinct applications: a Quick Reduce Pipeline (QRP) and a Science Pipeline. The QRP reduces data in near-real time at the telescope, and applies all basic calibration steps, such as bias and dark subtraction, flat fielding, and sky subtraction. It also determines the WCS solution for each exposure by matching stars against the 2MASS catalog, and uses the stars in common with 2MASS to determine a first-order photometric calibration. Finally, it combines data for the same pointing to create deep dither stacks. At the same time, the QRP records data quality metrics, in particular those pertaining to the observing conditions (such as seeing, photometric zeropoint, sky levels), and reports these to the user in graphical form. At the end of an observing block, the data are processed by the Science Pipeline, which provides in-depth data reduction, including for example masking out of sources for improved sky subtraction, large-field mosaicked images, and data quality metrics for calibration and science data.

P7.19 The SPIRE data reduction pipeline

Davide Rizzo (Imperial College), Tanya Lim (Rutherford Appleton Laboratory)

The SPIRE instrument for the Herschel Space Observatory consists of two sub-instruments, a three channel imaging photometer working at 250, 350 and 500 um and an imaging Fourier transform spectrometer giving low resolution spectra between 194 and 672 um. The photometer images the three channels of the 8χ4' FOV simultaneously, as the beam is split by dichroics. The only moving part is a two axis beam steering mechanism placed at a pupil in the common input optics with the spectrometer. Both sub-instruments utilise arrays of NTD Germanium bolometer arrays, coupled to the SPIRE input beam with feedhorns. The imaging spectrometer is a Mach-Zender FTS design with the second input port being used to provide a nulling calibration source. The spectrometer 2.6' FOV is then covered by two detector ports, split into two wavelength bands. The data processing for SPIRE is a unique design based on existing schemes for similar bolometer instruments and the unique features of the SPIRE optical design. This poster, concentrates on the algorithmic design of the pipeline based on the analysis of test data. It also discusses some of the alternative designs under consideration and gives the reasons for the design adopted.

P7.20 Updates to TFIT: a photometry package for mixed-resolution datasets

Victoria Laidler (CSC/STScI), Norman Grogin (Arizona State University), Henry C. Ferguson (Space Telescope Science Institute), Casey Papovich (University of Arizona/Steward Observatory), Mark Dickinson (National Optical Astronomy Observatory)

We report the progress on the TFIT software package since ADASS 2005. The stages of TFIT processing have been refactored; a unified pipeline framework now provides clear control over the flexible pipeline. New diagnostics have been devised, including a 'covariance index' that provides additional information about the effects of crowding. This package was developed for the GOODS multiwavelength dataset that includes HST/ACS 0.1' resolution images through Spitzer/IRAC 1–2' resolution images. TFIT is now in beta release and available as part of AstroLib at `http://projects.scipy.org/astropy/astrolib/`.

P7.21 SkyProbe BV pipeline: a two-color absolute sky transparency monitor

Jean-Charles Cuillandre (Canada-France-Hawaii Telescope), Eugene Magnier (Institute for Astronomy)

The CFHT absolute sky transparency monitor has been upgraded to a two-channel system. The original single channel system measured in the V band the absolute transmission of the atmosphere on the field pointed by the telescope through the use of a small CCD camera with a field of view wide enough to always capture once a minute more than 100 stars of Hipparcos' Tychos catalog. This system has proven crucial for decision making in the CFHT queued service observing, representing today 80% of the telescope time. The new dual color system (simultaneous B & V bands) will allow a better characterization of the sky properties atop Mauna Kea and will enable a better detection of the thinner cirrus (absorption of 0.05 mag.or less). This new system saw first light in May 2007. The first results will be presented, with a focus on the data processing pipeline and its integration in the CFHT queued service observing toolbox.

8. General Software and Tools

P8.1 MissFITS and WeightWatcher: two optimized tools for managing FITS data

Chiara Marmo (Institut d'Astrophysiques de Paris), Emmanuel Bertin (Institut d'Astrophysique de Paris)

We present the latest versions of MissFITS and WeightWatcher, two software packages dedicated to handling very large amounts of FITS data in a fast and optimised way. Metadata are generated as VOTables and can easily be accessed as web pages using the provided XSLT interfaces.

P8.2 The DAMIAN Digitiser

Jean-Pierre De Cuyper (Royal Observatory of Belgium), Lars Winter (Royal Observatory of Belgium), Georges de Decker (Royal Observatory of Belgium)

The DAMIAN Digitiser (Digital Access to Metric Images Archives Network), a high precision plate and film digitiser developed at Royal Observatory of Belgium finished construction and will become available soon. We present the first results. A comparision is made with existing purpose build plate measuring machines and commercial scanners.

P8.3 CASA - The Common Astronomy Software Application

Shannon Jaeger (University of Calgary - ALMA)

CASA is a tool for doing data analysis and reduction with radio, astronomical data. The tool has both graphical and command-line interfaces. The command-line interface is in a Python shell which enables users to take full advantage of the Python envrionment.

P8.4 CIAO 4 Infrastructure – Moving in a modular direction

Janet Evans (Smithsonian Astrophysical Observatory), Mark Cresitello-Dittmar (Smithsonian Astrophysical Observatory), Stephen Doe (Smithsonian Astrophysical Observatory), Ian Evans (Smithsonian Astrophysical Observatory), Gregg Germain (Smithsonian Astrophysical Observatory), Kenny Glotfelty (Smithsonian Astrophysical Observatory)

The next major release of the Chandra Interactive Analysis of Observations(CIAO 4.0) software package provides us the opportunity to reassess user interfaces and modernize infrastructure.

The CIAO infrastructure has been redesigned to achieve package independence in CIAO 4.0. Our major applications (Sherpa and ChIPS) and the CIAO tool set are available separately or in combination. This configuration has the advantage of allowing us to patch independently small, well-defined parts of the system.

The Python scripting language has been introduced as a user environment in CIAO 4.0, along with continued support of the S-Lang scripting language. The integration of Python and S-Lang has been carefully designed to provide a high-level user-friendly interactive interface together with scripting capabilities that have access to data structures. The syntax of high-level commands are closely matched between the environments to provide ease of use and low maintenance.

New data access libraries (Crates and Transforms) have been developed to provide separation of data access from the application processing where possible. Crates wraps the CIAO Datamodel (DM) library, and provides a scripting interface with all of the capabilities of the DM (including filtering) from either Python or S-Lang. The Transform library provides a high-level interface for performing World Coordinate System transformations. Both support direct interactive access by the user and are called internally by applications that need to use these functions.

New implementations of ChIPS and Sherpa were the main functional drivers of CIAO 4.0. Because we anticipate use of the major applications outside of the X-ray astronomy community, we have provided hooks for users to replace Crates or ChIPS (in the case of Sherpa) with other modules such as Pyfits (for data i/o) and Matplotlib (for plotting).

We describe the new 'face' of CIAO, the internal restructuring, the factors that led to the changes, and our vision for further development.

P8.5 cplmm: a C++ wrapper to the common pipeline library of ESO

Sergio Pascual (Departamento de Astrofisica, Universidad Complutense de Madrid)

I present here cplmm, a set of C++ wrappers to the Common Pipeline LIbrary of ESO. Cpl is written in pure ANSI-C with object-orientation in mind. Cplmm plans to wrap the native C classes to bring the power of C++ (exceptions, inheritance...) to the pipeline developement together with the robustness of cpl. Pipelines built with cplmm can be loaded with ESO's pipeline tool esorex.

P8.6 Developments in the AST library

David Berry (Univeristy of Central Lancashire)

The AST library provides a comprehensive range of general purpose facilities for managing and manipulating world coordinate systems that describe astronomical data. Written in C, but with interfaces for various other languages, it is used within many applications including GAIA, DS9, SPLAT and XIMAGE. We present an overview of some of the newer functionality such as 3-dimensional cooordinate grids, definition of regions within arbitrary coordinate systems, support for the HEALPix FITS-WCS projection, XML data formats, new specialist coordinate Frames to describe time and dual-sideband spectra and new classes of Mappings

P8.7 ESO Reflex: A Graphical Workflow Engine for Data Reduction

Richard Hook (ST-ECF / ESO), Marko Ullgren (Observatory, University of Helsinki), Sampo Team (Finland), Martino Romaniello (ESO)

Sampo is a project led by ESO and conducted by a software development team from Finland as an in-kind contribution to joining ESO. The goal is to assess the needs of the ESO community in the area of data reduction environments and to create pilot software products that illustrate critical steps along the road to a new system. Those prototypes will not only be used to validate concepts and understand requirements but will also be tools of immediate value for the community.

Sampo has developed a prototype application called ESO Reflex that integrates a modern graphical user interface and existing legacy data reduction algorithms. Most of the raw data produced by ESO instruments is reduced using CPL recipes: compiled C programs following an ESO standard and utilizing routines provided by the Common Pipeline Library (CPL). Currently reduction recipes are run in batch mode as part of the data flow system to generate the input to the ESO/VLT quality control process and are also exported for use offline. ESO Reflex can invoke CPL-based recipes in a flexible way through a general purpose interface.

ESO Reflex is based on a state-of-the-art graphical workflow engine called Taverna that was originally developed by microbiologists. Workflows have been created so far for three VLT/VLTI instruments, and the easy-to-use GUI allows the user to make changes to these or create workflows of their own. Python scripts or IDL procedures can be easily brought into workflows and a variety of visualisation and display options, including custom product inspection and validation steps, are available. ESO Reflex was released to a group of selected testers in early 2007 and their feedback has been incorporated into a beta V1.0 release in summer 2007.

This contribution will describe ESO Reflex and show several examples of its use, with the emphasis on newly implemented features.

P8.8 GOSSIP, a new VO compliant tool for SED fitting

Paolo Franzetti (INAF - IASF Milano), Marco Scodeggio (INAF - IASF Milano), Bianca Garilli (INAF - IASF Milano), Marco Fumana (INAF - IASF Milano), Luigi Paioro (INAF - IASF Milano)

We present GOSSIP (Galaxy Observed-Simulated SED Interactive Program), a new tool developed to perform SED fitting in a simple, user friendly and efficient way. GOSSIP automatically builds up the observed SED of an object (or a large sample of objects) combining magnitudes in different bands and eventually the optical spectrum, and then performs the fitting procedure versus a set of synthetic models in batch mode (on a single CPU or on a BEOWULF cluster). User defined synthetic models can be used, but GOSSIP is also able to load directly the output data files produced by the most used synthesis population codes (PEGASE and Bruzual & Charlot). GOSSIP also performs post-fitting operations like computation of absolute magnitudes and Probability Distribution Functions for the models parameters and is able to send the results to other tools using the PLASTIC protocol (like TOPCAT or VISIVO for visualization). Since GOSSIP has been developed with large data sets applications in mind, it has been naturally extended to operate within the Virtual Observatory framework. GOSSIP has been written using the PYTHON language for the graphical part and the C language for the computational part.

P8.9 IRAF: Developing in a New Age

Mike Fitzpatrick (National Optical Astronomy Observatory)

For many astronomers, data analysis is still a single-desktop experience. However, new projects are relying more than ever on distributed data and computing systems in order to meet the requirements of large surveys and the avalanche of new data offered by the Virtual Observatory and telescopes such as LSST. A large fraction of new software developed in astronomy is focused on the needs of these large-scale projects, and mainstay desktop systems such as IRAF are now generally supported by its user community. IRAF development, however, has recently resumed at NOAO as part of a broad strategy in which the functionality of the system is recognized as a proven component that can be utilized by other NOAO Data Products Program (DPP) missions, and one which operates collaboratively with the IRAF community who are ultimately its customers. In this paper we describe recent developments in the system related to the (current and future) use of IRAF in projects such as NVO, pipeline systems, archiving and web services. We will discuss how these developments fit within a larger DPP plan, and how the release of new software and the subsequent feedback drive new projects within both NOAO and the iraf.net community. New external packages providing NVO and IR reduction capabilities, as well as new IRAF and XImtool releases can be seen at the demonstration table.

P8.10 Slicing Image and Cube products in Herschel DP

Wim De Meester (Instituut voor sterrenkunde)

The Data Processing software for ESA's Herschel Space Observatory is written in Java as a joint effort of ESA and the three instrument teams. The observers as well as the instrument specialists will use a jython environment to reduce the science observations and to analyse the calibration measurements of the instrument.

Several observing modes of the Herschel space observatory will result in substantially large image or image cube datasets, up to several gigabytes in size. Having one or several of these data products in memory in the interactive reduction environment is not feasible on the computer systems available to the average Herschel observer. Therefore we have developed sliced image and cube datasets. Goal is to give the user interactive access to large images or cubes stored on disk, by adequately slicing the dataset in sub-images or subcubes that are manageable in memory.

We discuss our class modeling and java implementation of sliced images and cubes using the product pool infrastructure of the Herschel DP system. This infrastructure allows to write products to local disk, remote servers or databases. We show how our model hides the saving and loading of slices.

We also elaborate on the slice sizing scheme we have adopted. The choice of size and dimension of slices is crucial for an optimal performance. The slice sizing strategy we present can be of use for other data analysis applications that handle large datasets.

P8.11 Starlink Software Developments

Malcolm Currie (Rutherford Appleton Laboratory), Peter Draper (University of Durham), David Berry (Joint Astronomy Centre), Tim Jenness (Joint Astronomy Centre), Brad Cavanagh (Joint Astronomy Centre), Frossie Economou (Joint Astronomy Centre)

The Starlink Software Collection continues to be vigorously developed under the auspices of the Joint Astronomy Centre, Hawaii. Its flexible, extensible, object-oriented data and co-ordinate systems enables it to adapt to the increasingly complex data from modern instruments. Since 2005, our focus has been towards general spectral-cube reduction and analysis tools, the latter co-operating via PLASTIC; providing access to Virtual Observatory servers; and reduction pipelines. We present illustrated highlights of previously unreported facilities created since the software was released to the community under the GPL.

P8.12 The Photo Dissociation Region Toolbox

Marc Pound (University of Maryland), Mark Wolfire (University of Maryland)

Ultraviolet photons from young, hot stars play an important role in controlling the structure and emission spectra of the interstellar medium . The most obvious expressions of this influence are H II regions, the ionized gas surrounding massive star-forming regions. The sharp edges of H II regions mark the limit of influence of H-ionizing but far-ultraviolet (FUV) photons (6 eV $<$ hν $<$ 13.6 eV) play important roles in the chemistry, heating, and ionization balance of photodissociation regions (PDRs) that lie beyond the H II regions. We have developed a suite of web-based tools, called the PDR Toolbox, that allows users to determine the physical parameters of a PDR from a set of spectral line observations. Typical observations of both Galactic and extragalactic PDRs come from ground-based millimeter and submillimeter telescopes such as CARMA or the CSO, or space-based telescopes such as Spitzer, ISO, SOFIA, and Herschel. Given a set of observations of spectral line intensities, PDR Toolbox will compute best-fit FUV incident intensity and cloud density based on published models of PDR emission. The PDR Toolbox is available at `http://dustem.astro.umd.edu/pdrt/`

P8.13 The Transform Library - A high-level interface to coordinate systems

Janine Lyn (SAO), Mark Cresitello-Dittmar (SAO), Douglas Burke (SAO), Stephen Doe (SAO), Ian Evans (SAO), Janet DePonte Evans (SAO)

The Transform Library is a new, stand-alone software package developed by the Chandra X-ray Center (CXC), that provides a convenient high-level C++ interface for performing World Coordinate System transformations. The library wraps a subset of the lower-level wcslib functions to provide an easy interface to both users and developers. The Transform library is designed to be used within C++ programs and various scripting environments. Notably, we provide high-level user interfaces in Python and S-Lang for ease of use.

The Transform Library consists of C++ classes and methods for performing transformations on input base arrays (table data or image axes), for accessing and manipulating required transform parameters, and for calculating the transform matrix. Transform types include pixel to world coordinate transforms and vice versa, as well as linear transforms and scaling transforms. The design allows for transform chaining, so the user is able to combine multiple transforms into more complex arrangements.

The Transform Library will be integrated in the new versions of ChIPS and Sherpa that will be released in CIAO4. In addition, CIAO users will be able to use the library directly via the scripting languages. This provides the ability to easily create highly specialized applications to suit the user's particular needs.

P8.14 Towards a GUI for the SPIRE pipeline

Christophe Ordenovic (Laboratoire d'Astrophysique de Marseille), Christian Surace (LAM)

We present a convenient way for a user to deal with SPIRE photometer and spectometer pipeline scripts. The UI displays the list of tasks defined into a script. The user can choose tasks to be executed, parametrize them and set breakpoints during the pipeline execution. Results can be displayed and saved in FITS and VOTable formats.

P8.15 MUSE: an astrophysical Multiscale Multiphysics Scientific Environment for simulating dense stellar systems

Peter Teuben (University of Maryland), Breanndan O Nuallain (U of Amsterdam), Piet Hut (Institute for Advanced Study), Steve McMillan (Drexel U), Simon Portegies Zwart (U of Amsterdam)

MUSE is an astrophysical Multiscale Multiphysics Scientific Environment for simulating dense stellar systems such as globular clusters and galactic nuclei. It is free to download, use, and distribute.

The main objectives of the project are: 1) to develop a self consistent software environment for modeling dense stellar systems, and 2) to write an initial paper describing this environment.

This poster describes our progress and our recent MODEST-7a workshop in Split, Croatia.

P8.16 Porting the IRAF to x86_64 OS

Chisato Yamauchi (Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency)

The IRAF is a legacy software system indispensable for observational astronomy. Many of the professional telescopes utilise the IRAF to provide data redction pipelines.

However, the official IRAF software cannot run under the native x86_64, since the IRAF source assumes that the size of integer is 32 bits and some codes in the IRAF substitute an address for an integer variable. The

IRAF uses the f2c when compiling the SPP codes, and the f2c converts the 'integer' in FORTRAN into the 'long' in C (The size of 'long' is 64 bits under x86_64). In other words, if the IRAF source does not assume the size of integer, the IRAF can run under the native x86_64 OS.

We have started the IRAF64 Project to port the IRAF to native x86_64, and we have modified necessary codes of the IRAF kernel. As a result, the IRAF software is compiled successfully on the x86_64 native environments, and the xc compiler, mkpkg, cl and basic tasks (e.g. display, imstat, imcombine, phot, etc.) work properly.

As a by product, we have found a lot of buffer-overflow problems in C codes in the IRAF, and we have fixed them. We aim to relase the first test binary packages by the end of 2007.

9. Instrumentation

P9.1 Algorithms to model the multi-object spectrograph JWST/NIRSpec Instrument

Xavier Gnata (CRAL), Pierre Ferruit (CRAL)

The near-infrared multi-object spectrograph NIRSpec will be a major piece of the instrument suite of the future James Webb space telescope (JWST). In its multi-object spectroscopy mode, NIRSpec will allow the JWST users to obtain spectra in the 0.6 to 5.0 microns range of more than one 100 objects over a 9 square arcminutes field of view in a single exposure. As part of the NIRSpec project led by EADS Astrium and funded by the European Space Agency (ESA), we are developing a complete model of the instrument taking into account both optical aberrations and diffraction effects (based on the Fourier optics formalism). One major challenge is to be able at the same time to describe accurately all the modes of this complex instrument over more than three octaves in wavelength and keep the software complexity, computation time and memory needs below reasonable limits. In this paper we will describe the model being used, insisting on the problems that have been encountered and the solutions that have been implemented.

P9.2 Ionospheric Calibration for Interferometers

James Anderson (Joint Institute for VLBI in Europe), Maaijke Mevius (ASTRON), Jan Noordam (ASTRON)

Ionospheric calibration is becoming increasingly important for radio astronomy as new low-frequency radio telescopes are being constructed and the performance of existing instruments is upgraded. We present developments at JIVE/ASTRON to model the ionosphere for instruments such as LOFAR, the European VLBI Network, MERLIN, and the VLBA. We use dense networks of GPS stations to provide data to test our ionospheric modeling algorithms. We are currently achieving residual levels for relative ionospheric corrections of 0.05 TECU (1 TECU = 1E16 electrons per square meter, or 4/3 of a turn of phase at 1 GHz, or about 13 turns of phase at 100 MHz). We expect to reach residual levels of 0.01 TECU in a few months of further development. This calibration level is good enough to fully calibrate the ionosphere for gigahertz frequency observations, and to provide a starting point for calibration of observations below 100 MHz.

P9.3 The NEWFIRM Data Handling System

Nelson Zarate (NOAO), Mike Fitzpatrick (NOAO)

One of the NOAO NEWFIRM instrument software system is the DHS which receives metadata information and imaging frames from the MONSOON data acquisition system and queued them into shared memory where the Data Capture Agent reads and sends them via Message Bus to the client processes that write Multiple Extension Fits files (MEF). Control information about the different processes is displayed in GUIS as well as a Quick Look display.

P9.4 A Simulator for the Long Wavelength Array (LWA)

Masaya Kuniyoshi (University of New Mexico), Sanjay Bhatnagar (National Radio Astronomy Observatory, Soccoro), Greg Taylor (University of New Mexico)

The LWA will be a radio telescope operating in the frequency range 20–80MHz with a high spatial resolution (arcsecond) and mJy sensitivity, where the detailed observation has never done before. The LWA will consist of about 50 stations spread over New Mexico in the US SoutWest. Each station is made up of about 256

dipoles spread in region of 100m diameter. The dipole configuration is determined such that the synthesized beam has minimal grating lobes. At present, the LWDA (Long Wavelength Demonstration Array) is being installed near the VLA site and test observations are being performed. We are working on developing the LWA simulator. LWA simulations with the dominant error terms (ionosphere effect, LWA station primary beam, etc.) are crucial in further research on imaging and calibration algorithms for LWA. First, in order to examine the variation of a LWA station primary beam regarding to the elevation, simulations were carried out with a real dipole primary beam, bandwidth and probably an actual configuration of dipoles. As a result, it turns out that the primary beam shape gets asymmetric and generates errors at the beam/pointing center as well as a function of elevation angle. In this paper we describe the simulation results of a LWA station beam in detail.

P9.5 A template based SOA developer framework for astronomical instrumentation

Juergen Berwein (Max Planck Institute for Astronomy), Juergen Berwein (Max Planck Institute for Astronomy), Florian Briegel (Max Planck Institute for Astronomy), Wolfgang Gaessler (Max Planck Institute for Astronomy)

We present a new flexible developer framework or high performance SOA based systems, using the middleware ICE by ZeroC Inc. for interprocess communication. The framework was developed at the Max Planck Institute for Astronomy in Heidelberg/Germany within the scope of the LBT interferometer Linc-Nirvana control software, but may also be used, in respect of its flexibility, for other of astronomical instruments. The systems architecture was designed to decrease the development time of large SOA based systems like astronomical instrument control software. The advantages of this new framework is the combination of online instrument data handling, validation and the ability to integrate user defined data manipulation, which can be executed during instrument operation. This way the developer/astronomer may include just-in-time data pipelining functionalities into the system.

P9.6 An end-to-end simulator for the Herschel Photo-Conducting Array Camera & Spectrometer.

Babar Ali (IPAC/Caltech), Rene Gastaud (CEA/Saclay), Koryo Okumura (CEA/Saclay), Daniel Dang (CEA/Saclay), Giulia Rodighiero (U Padua)

We have developed code to simulate the propagation of light end-to-end, ie., from an input sky field through all of the optical and electrical/detectors interfaces, for the Herschel Photo-Conducting Array Camera & Spectrometer (PACS). The code accounts for all of the expected major systematic and Gaussian noise sources, as well as astrophysical phenomena such as cosmic ray hits. In this contribution, we describe the code and present some initial results from our simulations.

P9.7 CONRAD Software Architecture

Juan Guzman (CSIRO ATNF), Thomas Bennett (KAT), CONRAD team (CONRAD)

The Convergent Radio Astronomy Demonstrator (CONRAD) is a collaboration between the computing teams of two SKA pathfinder instruments, meerKAT (South Africa) and MIRANdA (Australia). Our goal is to produce the required common software to operate, process and store the data from the two instruments. Both instruments are synthesis arrays composed of a large number of antennas (30 − 100) operating at centimetre wavelengths with wide-field capabilities. Key challenges are the processing of high volume of data in real-time as well as the remote mode of operations. Here we present the software architecture for CONRAD. Our design approach is to maximise the use of open solutions and third-party software widely deployed in commercial applications, such as SNMP and LDAP, and to utilise modern web-based technologies for the user interfaces, such as AJAX.

P9.8 JWST Project - Instrument Performance Simulator of the NIRSpec Spectrograph

Laure Piqueras (CRAL - Observatoire de Lyon), Pierre-Jacques Legay (CRAL - Observatoire de Lyon), Emeline Legros (CRAL - Observatoire de Lyon), Emmanuel Quemener (CRAL - Observatoire de Lyon), David Magot (CRAL - Observatoire de Lyon), Peter Mosner (ASTRIUM)

The future James Webb space telescope (JWST), developed jointly by the American, European and Canadian space agencies (NASA, ESA and CSA), is scheduled for launch in 2013. The near-infrared spectrograph NIRSpec will be a major element of its instrument suite and is built by EADS Astrium for ESA. NIRSpec is a multi-object spectrograph allowing astronomers to obtain the spectra of more than one hundred objects in one shot. Given the complexity of the NIRSpec instrument, it was found necessary to develop an instrument performance simulator (IPS) software. In this context, the Centre de Recherche Astrophysique de Lyon (CRAL) is responsible of the development of this simulator that will serve as a basis for early performance verification purposes; provide inputs and support for the verification and calibration campaigns, as well as for the development of the instrument calibration, target acquisition and data reduction procedures. In this paper, we will present this IPS software that will be able to generate simulated NIRSpec detector exposures for the various modes of the instrument (multi-object, integral field unit, fixed slits) and for a large variety of situations (test, calibration, scientific observations...).

P9.9 LOFAR Core Station 1 post-processing and inspection tools

Adriaan Renting (ASTRON)

Core Station 1 (CS1) is the first station of the LOFAR (LOw Frequency ARray) radiotelescope. CS1 is becomming operational starting end 2007 as a prototype for the full LOFAR telescope using baselines of up to 500m. On this poster the current status of the post-processing and inspection tools for processing the CS1 data will be presented. These include data manipulation, flagging, imaging and various plotting tools, specially developed to handle the CS1 data.

P9.10 Modular Mission Planning and Scheduling systems in the WSO-UV observatory

Juan Carlos Vallejo (GMV, Aerospace and Defence, S.A.), Rafael Vazquez (GMV, Aerospace and Defence, S.A.)

A modular design for the ground segment of the ROSCOSMOS WSO-UV (Spectrum-UV) mission is being considered. By building the Science Operations Center using modular blocks, it is foreseen that baseline requirements will be fulfilled, but which is more important, the SOC will be enough flexible to cope with major changes during the whole observatory mission expected lifetime (10yrs). In this way, new changes taking advantange of emerging new technologies will be easily incorporated and the scientific return maximized along the years. A key point in the success of the mission will be the mission planning and scheduling facilities. They will be based in such a modular design, able to cope with modifications in the several constituents of the system. Taking as baseline GMV's FlexPlan tools, already in use by ESA, Eumesat and NASA, which provide of an open enough architecture, new capabilities for the WSO-UV observatory will be added with this approach. In this contribution we will focus in three parts of the system. First, in the necessary Flight Dynamics capabilities, able to provide the necessary support in the planning cycle for the routinary targeting of the telescope, by taking into account the visibility and slewing constraints, being linked to the mission operational catalgue, currently under construction. We will also describe the strategy

for implementing optimization algorithms, which will allow the maximum optimization of the available time. Finally, it will be also described how the mission planning system will be linked to the mission science archive, in order to allow the planner (or autoscheduler) the required access and process capabilities to the astronomical data of the targets.

P9.11 Numerical simulation of the VLT/MUSE instrument

Aurélien Jarno (CRAL), Roland Bacon (CRAL), Pierre Ferruit (CRAL), Arlette Pecontal (CRAL)

The MUSE (Multi Unit Spectroscopic Explorer) instrument is a second-generation integral-field spectrograph in development for the VLT, operating in the visible and near IR wavelength range (465 930 nm). It is combining a large 1'x1' Field of View with a spectral resolution of 3000 and a spatial resolution of 0.2' coupled to a sophisticated ground-layer Adaptive Optics (AO) system. Given the complexity of the MUSE instrument we are developing a numerical model of the instrument based on Fourier optics formalism, taking into account both optical aberrations and diffraction effects. It will serve as a basis for early performance verification purposes, provide inputs and support for the testing phases, as well as for the development of the instrument calibration and data reduction procedures. In this paper we will present the end-to-end simulator software that has been written to accurately model this complex instrument in all its modes and up to the detector readouts.

P9.12 Software we cannot find for robotics telescopes,.

Petr Kubánek (GACE, Valencia and IAA, Granada), Martin Jelínek (IAA, Granada), Stanislav Vítek (IAA, Granada), John French (UCD, Dublin), Martin Nekola (AsU AV ČR, Ondřejov)

We spend considerable amount of time developing, installing and monitoring open-source package for robotics observatory control, primary aimed at fast GRB follow-ups. We integrated few image processing steps inside our observatory control system, but we still know we miss lot of interested events, which might be interesting for others, non-GRB related, observers.

We have a list of missing pieces of software. As we cannot find any market solutions for those, we develop our own solutions, which is of course more difficult then using avaliable one. The list includes pure Java astronomical calculation library, web interface for RT, global RT planner and scheduler with display of instrument status and feedback with observations done. All items will be presented in the presentation.

P9.13 The LOFAR Data Access Layer

Joseph Masters (ASTRON, Universiteit van Amsterdam), Lars Bahren (ASTRON, Radboud University Nijmegen), Michael Wise (ASTRON, Universiteit van Amsterdam)

LOFAR is a new interferometric radio telescope array under construction in The Netherlands. It will operate between 30 and 240 MHz, providing unprecedented sensitivity and resolution with which to explore the low-frequency radio sky. We present the LOFAR Data Access Layer (DAL), a portion of the software system that abstracts the data product file format from the user to provide a common interface for interacting with radio astronomy data. This layer will interact with a variety of file formats including HDF5, CASA Tables/Measurement Sets, and raw binary. There is an emphasis on the HDF5 format, which holds the most promise for LOFAR data products. HDF5 is a flexible format for scientific data with support for parallel I/O, compression, tiling and distributed storage.

P9.14 The UCM Instrument & Telescope Astronomical Software Group

Nicolas Cardiel (Universidad Complutense de Madrid), Sergio Pascual (UCM), Carmen Eliche (UCM), Africa Castillo (UCM), Jesús Gallego (UCM)

In this poster we present a summary of the activities carried out within the UCMITAS group. At present we are focused in the development of data reduction pipelines for three future instruments for the 10 m Gran Telescopio Canarias.

P9.15 Using MeqTrees to simulate arbitrary Meaurement Equations, and to solve for their parameters

Jan Ewout Noordam (ASTRON), Oleg Smirnov (ASTRON)

MeqTrees are designed for implementing the Measurement Equation (instrumental model) of an arbitrary observing instrument, and to solve for (arbitrary subsets of) its parameters. This makes it a powerful tool for simulation and calibration. We have reported on the MeqTree principle at earlier ADASS conferences. The module is now mature, and plays an important role in the next generation of giant radio telescopes (e.g. LOFAR and SKA). It is also used for the continuous alignment of the optical surfaces in the next generation of optical/IR telescopes, which cannot rely on passive mechanical stability any more.

P9.16 Web-based Interfaces to Telescope Control Systems at the MMT

Timothy Pickering (MMT Observatory), Duane Gibson (MMT Observatory), Skip Schaller (MMT Observatory), Dallan Porter (MMT Observatory), Tom Trebisky (MMT Observatory)

The rapid development and proliferation of web technologies such as AJAX now allows one to create full-featured graphical interfaces that require only a relatively modern browser to implement. In this paper we describe how the MMT has implemented various TCS interfaces using these technologies. We also describe interfaces we've developed that use browser plugins such as flash and java applets. We discuss the relative merits and drawbacks of these different approaches as well as the advantages/pitfalls of using web browsers versus interfaces built with more traditional platform toolkits like tk, gtk, or qt.

10. Miscellaneous

P10.1 A Rule-Based Data Quality Startup Using PyCLIPS

Ronald DuPlain (National Radio Astronomy Observatory, Charlottesville)

A rule-based approach to data quality provides for efficient and extensible solutions in validating data sets. A working prototype proves that CLIPS, a trusted rules engine, can integrate with existing data processing libraries through PyCLIPS, resulting in a system which isolates data quality rules from programming logic to allow for parallel development and maintenance of rules and applications. The prototype demonstrates several benefits: developers can treat rules independently from application source code, a ruleset can accept new rules without modification of existing rules in the set, rules can provide value through conditional assertions which call on external tools, and even a very small rule set can point to real errors in telescope data. A rules engine which automates data quality validation with existing tool libraries could potentially lead to a substantial increase in operational availability even when faced with resource scarcity.

P10.2 Astronomy and the Problem of Network Transfers

Johann Bryant (Institute for Astronomy), Ross Collins (Institute for Astronomy), Nicholas Cross (Institute for Astronomy), Nigel Hambly (Institute for Astronomy), Mike Read (Institute for Astronomy), Eckhard Sutorius (Institute for Astronomy)

During the lifetime of a survey a considerable amount of data are produced, this data needs to be copied between processing centers quickly and efficiently. Over time there has been a jostling between which method of transferring data from one location to another is best; tape, disk or network, as they say 'Never underestimate the bandwidth of a station wagon full of tapes hurtling down the highway.'! With the VDFS we have been fortunate in that the most painless solution seems to have been using network transfer (as anyone who has been through X-ray machines at airports with magnetic media would hope!) We started by using JANET to transfer our data but the rising monetary cost and unreliable transfer speeds when dealing with terabyte scale data volumes led us to investigate alternatives. Here we describe our work on connecting to the UKLight network run by UKERNA alongside the JANET network. This network has provided us with a dedicated 1GByte/s dark fibre for our sole use that allows us to transfer astronomical data between CASU and WFAU at a speed that is limited more by the end server hardware than by the network so maybe we can beat that station wagon!

P10.3 Compact analytical representation of lunar ephemeris over six thousand years

Sergey Kudryavtsev (Sternberg Astronomical Institute of Moscow State University)

Modern numerical ephemerides of the major planets and Moon are very accurate but take hundreds of megabytes in size because they are usually represented by a large number of short-term Chebyshev polynomials. We show that over long periods of time it is more effectively to represent the ephemerides by compact Poisson series where both amplitudes and arguments of the series terms are high-degree polynomials of time. To prove that we made harmonic development of the latest long-term numerical ephemeris of the Moon, LE-405/406, to accurate Poisson series by using an original modification of the spectral analysis method. The complete development (LEA-406a) includes 42270 terms of minimal amplitude equivalent to 1 cm and is valid over 1500 2500. The simplified version of the development (LEA-406b) includes 7952 terms of minimal amplitude equivalent to 1 m and is valid over 3000AD 3000BC. The maximum difference in lunar coordinates r (geocentric distance), V (ecliptic longitude) and U (ecliptic latitude) calculated by means of the new analytical development LEA-406a and numerical ephemeris LE-405/406 over 1500–2500 is 3.2 m, 0.0056", and 0.0018", respectively. Over 3000BC-3000AD the maximum difference in r, V, U coordinates

calculated by means of LEA-406b and LE-406 is 0.20 km, 0.42" and 0.33", respectively. The compactness and accuracy of the new development are better than similar characteristics of any modern analytical theory of lunar motion. The work is supported in part by grant 05–02-16436 from the Russian Foundation for Basic Research.

P10.4 Detection vs. Discovery Oriented Observations

Anton Chernenko (IKI)

As the sensitivity, spectral and temporal resolution of space and ground based experiments increase, scientists are forced to search increasingly huge phase space volumes (e.g. brightness x position x variability scale x color... etc) in order to detect objects of interest.

Various resource limitations, such as detector sensitivity it space experiments or computer power in large earth-based telescopes push the experimenter to use prior information to limit the phase space at the design stage to make the experiment feasible. As as result, an observer using the data obtains the possibility of detecting more objects with known or predicted properties at the expense of loosing an ability to discover objects with unknown or unpredicted properties.

We discuss qualitatively this detection vs. discovery tradeoff and possible design approaches that could provide more flexibility to observers.

P10.5 Getting More From Your Multicore: Exploiting OpenMP for Astronomical Analysis

Michael Noble (Massachusetts Institute of Technology)

We introduce SLIRP, a module generator for the S-Lang numerical scripting language, with a focus on its vectorization capabilities. We demonstrate how both SLIRP and S-Lang were easily adapted to exploit the inherent parallelism of high-level mathematical languages with OpenMP, allowing general users to employ tightly-coupled multiprocessors in scriptable research calculations while requiring no special knowledge of parallel programming. Motivated by a common problem in observational astronomy, model fitting, we present beneficial speedup figures for several machine and compiler configurations, using the ISIS astrophysical modeling & analysis tool.

P10.6 Proposal handling and beyond using NorthStar

Hanno Holties (ASTRON), Anton Smit (ASTRON)

Northstar is the web based application in use by observatories around the world to handle the preparation and submission of proposals requesting telescope time. Initially developed for European radiotelescopes, it is currently used internationally and being adapted to fully support optical telescopes as well. In addition to most proposal submission tools, NorthStar provides extensive support for time allocation committees in the proposal assessment process. Future developments will concentrate on the further integration of NorthStar with observatory facilities for detailed preparation and scheduling of observations. In this presentation, the current state of NorthStar will be discussed as well as the place and integration of a proposal submission application in beginning to end support for the astronomical observation process.

P10.7 Proposed Changes to the FITS Standard

William Pence (NASA/Goddard Space Flight Center), Lucio Chiappetti (IASF Milano), Clive Page (University of Leicester/ Dept. of Physics & Astronomy), Richard Shaw (National Optical Astronomy Observatory), Elizabeth Stobie (University of Arizona/Steward Observatory)

This poster highlights the more significant changes that have been proposed by a technical panel appointed by the IAU FITS Working Group to update the FITS Standard document. The FITS Standard defines the rules for the FITS data format; it was last updated in 1999. About 15 of the proposed changes would modify existing FITS requirements or recommendations, or would add new requirements or recommendations; dozens of other changes have been proposed to clarify existing sections of the document, or to add new sections covering topics that are not currently discussed.

These proposed changes are now available on the FITS Support Office web site (`http://fits.gsfc.nasa.gov`) for review and public comment. These proposals may be modified in response to the comments that are received. Eventually, it is anticipated that the 4 regional FITS committees and then the IAU FITS Working Group will vote on whether to accept the proposed changes to the FITS Standard.

P10.8 Solutions of the Collinear Lagrange Points in the Circular Restricted Three-Body Problem with Radiation Pressure Using Fortran

Travis Stenborg (The University of Melbourne)

The effects of radiation pressure in the circular restricted three-body problem displace the Lagrangian equilibrium points from their classical locations. Presented here are components of Newton-Raphson solutions to the locations of collinear Lagrange points so displaced. Using a Fortran solution implementation, examples of the speed of solution convergence for valid approximate zeros (0.07 for r2 at L1, L2 and 1 for r1 at L3), for a radiation pressure relevant to asteroidal dust particles (b = 0.2), are explored quantitatively.

P10.9 System Administration Best Practices: An Astronomical Perspective

Patrick Shopbell (Caltech)

The literature contains numerous discussions of best practices concerning the administration of computing systems and networks. In this poster, we review these strategies and techniques, but with a special emphasis on those which are particularly applicable in the field of astronomy. We remind the reader of many common practices of importance, such as communication (both upward and downward) and documentation, but moreover emphasize a number of issues critical for the successful management of computer systems used in astronomy. As an example, the large, and rapidly increasing, data flows in astronomy today, as well as the increasing use of pipeline software on the desktop, are creating a much more dynamic environment with respect to data backups. We draw upon the experience of ourselves and others in this field over the past twenty years to suggest a few best practices for system and network administration which should be especially useful for those in the field of astronomy.

P10.10 Water Vapour Total Column Measurements with Elodie at Observatoire de Haute Provence from 1994 to 2005

Alain Sarkissian (Service d'Aeronomie), Jim Slusser (Colorado State University)

Water vapour total column measurements at Observatoire de Haute Provence, south of France, are obtained using observations of astronomical objects made between 1994 and 2005 on the 193 cm telescope with Elodie high resolution spectrometer. Spectra of stars, galaxies and other astronomical objects were taken regularly each night, during ten years, and more than 18 000 spectra are now available on-line for intensive exploitation of Elodie Archive. Water vapour absorption bands in the visible part of the spectra is often a problem for astronomers and they mask or it for analysis. We develop a workflow, i.e. is a suite of tasks using several data bases and several independent or dependent pipelines. The three dominating parts of this workflow are: on-line access to Elodie Archive data, spectral analysis and data delivery following VO format standard defined in the frame of the Astronomical Virtual Observatory. The workflow was developed with two objectives: firstly to retrieve seasonal variability and long term trend and secondly, to remove signatures in spectra for further exploitation. This workflow is, or pretend to be a tool for pluri-disciplinary research, for astronomy and geophysics. We uses, at different stages of this workflow, tools and standarts defined and developed in the frame of the International Virtual Observatory Alliance and results are provided (or will be soon) in VO format : a VOtable.

P10.11 The fact and future of Semantic Astronomy

Norman Gray (VOTech project/Univ Leicester/Univ Glasgow)

The ‘Semantic Web’ has turned from W3C Vision into a set of practical engineering challenges, more concerned with deployment and performance details than AI abstractions.

Now is therefore an excellent time to examine those goals, challenges and implementations, and the many consequent opportunities for astronomy, including semantic data access, data mining (exploiting distributed annotation and heterogeneous sources), and intelligent data dissemination and discovery.

We will present such a review, illustrating it with examples of the wide range of existing Virtual Observatory semantic applications, from the elaborate and formal to the informal and lightweight. The latter tools overlap with Web-2.0 style applications (notably in tagging and shared bookmarking), and indicate how we might adapt some of that community’s more successful ideas.

Throughout, the emphasis will be on how existing applications help us imagine further possibilities.

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