

MMDSL: a Multi-Mission Data Server at LAEFF

E. Solano, R. Gutiérrez, B. Montesinos¹, C. Morales and J. García
LAEFF. P.O. 50727, E-28080 Madrid, Spain

Abstract. We describe here the functionalities, contents and future implementations of the Multi-Mission Astronomical Data Server developed at LAEFF.

1. Introduction

The acquisition rate of astronomical data, both from space and ground-based observatories, has increased enormously in the last years. The possibility of studying regions of the electromagnetic spectrum that could not be reached until very recently has led to a spectacular growth of the multi-wavelength astronomy. However, a negative aspect affecting this growth is the lack of homogeneity that astronomical archives currently show. Historically, astronomical archives have been built independently of each other and this has meant that their remote interoperability is neither easy nor efficient, as demonstrated by the fact that the queries to multiple databases are done, most of the times, by hand. Interoperability is, therefore, one of the fundamental aspects for the Virtual Observatory (VO) and an essential requirement for the multi-wavelength astrophysical research.

Since January 2002 LAEFF has been developing, in the framework of the VO, a multi-mission data server to provide easy, efficient and uniform access to astronomical databases. A primary goal of this project is the implementation of science-driven tools. In this context, MMDSL provides an excellent framework to check the performance of utilities before their inclusion in the VO structure. This is a fundamental step in order to manage properly the huge flow of data expected from the VO federation of archive centres.

In this paper, the main functionalities and contents of the system are presented. The first version is foreseen to be released at the beginning of 2004 and will be available at <http://sdc.laeff.inta.es>

¹IAA-CSIC, PO Box 3004, E-18080 Granada, Spain

2. Contents

In the first phase, the system focuses on the integration of the ultraviolet archives maintained at LAEFF (EURD¹ and INES²) with the ESA astronomical archives hosted at VILSPA (XMM-Newton³ and ISO⁴). The coverage in the optical range is given by flux-calibrated Strömgren and Geneva photometry.

At the time of writing we are working on the implementation of the 2MASS Point-Source Catalogue. To give a coverage as complete as possible in the UV, future plans imply access to the ultraviolet missions available in MAST.

3. Functionalities

- Archive search: The query to the system is made by means of an HTML form (Figure 1) allowing different types of search: by object, list of objects, object type as given in SIMBAD, coordinates, date and mission. Particularly interesting is the possibility of posing scientifically-driven queries by using the search by object type. A built-in name resolver has been implemented which permits queries using any of the object names provided by SIMBAD.
- Results from searches:
 - Basic data information: For each object, the system provides basic information retrieved from SIMBAD. This includes coordinates in different systems, magnitudes, spectral type, parallax, radial velocity and/or redshift. If Strömgren photometry is available, the dereddened indices as well as the physical parameters are also displayed.
 - Data preview: A browse plot can be generated by clicking on the corresponding link. The system also incorporates a multiplot utility with zooming capabilities designed to allow users to visualize a combined average spectrum of different missions/instruments. The browse plot can be saved as a PNG file.
 - Links to publications: For the IUE, ISO and XMM-Newton missions it is possible to access the publications which have made use of a given observation. By clicking on the link, the abstract and/or the full paper are obtained through the ADS facility.
 - FITS header display: Links are provided to display the FITS header for the requested data.
 - Data retrieval: Data, delivered as FITS files, can be retrieved individually or in groups. Multiple retrieval generates a packed file in either

¹<http://laeff.esa.es>

²<http://ines.laeff.esa.es>

³http://xmm.vilspa.esa.es/external/xmm_data_acc/xsa/index.shtml

⁴<http://www.iso.vilspa.esa.es/ida/index.html>

LABORATORIO DE ASTROFÍSICA ESPACIAL Y FÍSICA FUNDAMENTAL
LAEFF
 LABORATORY FOR SPACE ASTROPHYSICS AND FUNDAMENTAL PHYSICS

Object ID:

Position:

Object List:

Object Type:

- Blue object | Blue object
- Composite object | Association of Stars
- Composite object | Cataclysmic Var. AM Her type
- Composite object | Cataclysmic Var. DQ Her type
- Composite object | Cataclysmic Variable Star
- Composite object | Cluster of Galaxies
- Composite object | Cluster of Stars
- Composite object | Compact Group of Galaxies
- Composite object | Composite object
- Composite object | Double or multiple star

Observation Data:

From:

To:

Order Output By:

XMM - Newton:

MINISAT 01:
 EUJD:

ISO:

USE: (International Ultraviolet Explorer)

Camera: LWP LWR EVF

Dispersion: Low High N/A

Aperture: Large Small N/A

Photometric Systems:

Strömgren: UBV:

Geneva: JP11:

show SQL

Figure 1. Example of an input query form.

- tar or ZIP format. Compression of packed files is recommended for network efficiency, in particular when large data sets are downloaded.
- On-line help: Help on a specific keyword can be obtained by simply clicking on it.
- On-line access to missions: For accessing detailed project documentation, the system incorporates a link to the Home Pages of the different missions.

4. Interoperability

To ensure real interoperability it is compulsory to adapt the system to the standards and recommendations agreed within the International Virtual Observatory Alliance. MMDSL is being adapted to be compliant with one of these standards: Cone Search, a basic component of SIAP (Simple Image Access Protocol). In short, to be Cone Search-compliant, the web server must be able to respond to an http GET request containing the coordinates (right-ascension and declination) of the central position and the radius of the search. The service must respond with a table of the objects found within the cone.

5. Analysis tools

The development of analysis tools for their further implementation in the Data Server constitutes an important added-value to the system and is in agreement with the Virtual Observatory goal that Data Centres should not be simple data repositories but they must incorporate tools to help users in the analysis. This will permit to transfer only results and not pre-analyzed data, a non negligible aspect given the vast amount of data handled in the Virtual Observatory federation of Archives. Implemented in the Data Centre the analysis tools can be shared and re-used and the expertise requirements on the user's side greatly reduced. It is clear that a Data Centre cannot cope with all potential scientific cases but this situation can be alleviated if collaboration with scientists in universities or research centres, acting as software tools writers, are established.

At present, MMDSL allows for comparisons between the observed spectral energy distribution of a stellar object and synthetic models. Another important facility implemented in the system is the determination of the physical parameters of early and mid-type stars from the Strömgren photometry using the most updated calibrations. Similarly, physical parameters of late-type stars will be derived from V-Johnson and 2MASS photometry following the method described in Ribas et al. (2003). Subsequent releases of the system will include the use of data mining tools for spectral classification and characterization of the observed spectral energy distributions.

References

Ribas, I., Solano, E., Massana, E. & Giménez, A., 1993, *A&A*, 411, L501