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# ALADIN: A Reference Tool for Identification of Astronomical Sources

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**Abstract.** ALADIN is the CDS interactive sky atlas used for source identification and interpretation, multi-wavelength cross-identification, and data quality control. ALADIN includes an image server which contains reference images from the Schmidt survey DSS–I, soon from DSS–II, and images digitized by the MAMA-CAI machine with higher resolution for crowded fields. It allows for the overlaying of information extracted from the SIMBAD database, the VizieR catalogue server, and private catalogues. The X–Window interface, available at CDS and at several French institutes, includes a source extraction facility as well as image compression solutions for image transfer. The new step is to provide access to images of objects from the various CDS services on the WWW. Linked to this quick view facility, a JAVA interface includes interactive graphical processing and source list overlay.

## 1. Introduction

Cross-correlation of data from different origins is certainly a major challenge for astronomy, particularly for multi–wavelength studies (e.g., Ortiz et al. 1999). One aspect of the problem is to implement tools allowing users to browse through distributed on–line resources. Astrobrowse (Heikkila, McGlynn, & White 1999) and AstroGLU (Egret, Fernique, & Genova 1998) are examples of discovery tools, allowing one to explore a large set of selected databases. In parallel, links permitting the users to navigate easily between on–line information of different kinds are developing rapidly to and from observational data, databases, bibliographic databases, published journals, etc.

The Centre de Données astronomiques de Strasbourg (CDS, see e.g., Genova et al. 1998) manages several reference databases, including SIMBAD, the catalogue service with the VizieR Catalogue Browser, the *Dictionary of Nomenclature of Astronomical objects outside the solar system*, and bibliographic services and tools, with mirror copies of the ADS bibliographic database and of

*The Astrophysical Journal*, *The Astronomical Journal*, and *The Publications of the Astronomical Society of the Pacific*. The links between all these services and with external databases are provided through the Générateur de Liens Uniformes (GLU), developed by CDS (Fernique, Ochsenbein, & Wenger 1998), which is also used in the Astrobrowse project.

The ALADIN project aims at producing a comprehensive software tool for combining astronomical data by providing simultaneous access to digitized sky photographs, catalogues and databases. The visual overlay of these kinds of information facilitates direct comparison of data from different origins.

## 2. The ALADIN Image Database

The Digital Sky Survey (DSS-I) (Lasker 1994) forms the core of the image database. The low resolution and light data compression (factor of 10) permit storage covering the full sky on a reasonable number of CD ROMs. These CD ROMS are stored at CDS in a juke–box connected to the image server. The second epoch survey (DSS-II) (Lasker et al. 1998) will be progressively integrated into the system in the near future.

For usage which requires higher resolution images, for example, when working in crowded regions of the sky or in areas with deep observations, the CDS has also built an archive of images digitized with 0.66 arcsec pixels (10 microns), in partnership with the MAMA facility (Guibert 1992) at the *Centre d'Analyse des Images* at the Observatoire de Paris (mainly ESO-R and SERC plates). These full resolution images are available for the southern Galactic Plane, the Magellanic Clouds, and a few smaller regions of specific interest. The archive is implemented on an optical disk juke–box with a storage capacity of 500 GB.

## 3. The ALADIN User Interface

An *X-Window interface* was developed, which overlays images from the image database with objects from SIMBAD, the VizieR service (including large catalogues and surveys such as GSC, TRC, ACT, or USNO A–2.0), and user provided lists of objects. A list of objects on the image can also be extracted and saved. The user may select a subset of catalogues from VizieR, save the information of interest in local files, and access SIMBAD and VizieR information for the plotted objects. The X–Window ALADIN interface has been made available at CDS and in several French institutes.

More recently, Web access to the image database has also been developed. The first objective was to provide access to reference images of the sky, for other CDS services, such as SIMBAD, the catalogue service, or the bibliography. This is done through the *ALADIN Previewer* which is implemented as a specific service[1] in the CDS Web hub. The images are compressed in JPEG–8 bit format in order to maintain a good response time (the volume transmitted is less than 30 kB). At a later stage, we plan to provide images compressed with the MR–1 package (PMT method, e.g., Louys et al. 1999).

[1] `http://aladin.u-strasbg.fr/aladin/alapre.pl`

The first link to other services is from the CDS bibliographic service to give access to an image of all the individual objects which are cited in the keywords of a published papers. For each object, two links are built, one to the information in SIMBAD, the other to the ALADIN image (using the coordinates from SIMBAD). The accuracy of the nomenclature found in the keyword list is checked beforehand. Similar links are also built and checked for object names tagged by authors in the *Astronomy and Astrophysics* abstracts. Links to the ALADIN Previewer will soon be installed in SIMBAD and then in the catalogue service.

In parallel, the development of a Java tool allowing one to overlay SIMBAD and catalogue information on the image and to perform interactive graphical processing is near completion. *ALADIN Java* extensively uses the ability to stack planes containing information from different origins (the image, SIMBAD objects, catalogue data, text and marks added by the user, etc.) and to overlay some or all of them. Interactive links to the complete information from SIMBAD and VizieR are also available. The ALADIN Java interface is implemented in two versions: a Java applet directly processed by the user Web browser and a stand–alone Java application requiring the installation of a Java virtual machine. Some limitations in the functionalities of the Java applet arise from the security restrictions of Java, namely from the fact that local resources cannot be accessed from Java applets. The stand–alone application (i.e., installed on a local machine) allows the user to also plot his or her own object list, provided that it is properly formatted. The user can also save ALADIN images locally in FITS format. For performance reasons, the image object extraction functions are not available in the Java interface at the present time (they are present in the X–interface). They may be added later, or provided by the image server.

## 4. Conclusion

Recent development of Web access to the ALADIN image database opens new powerful links from bibliographic information or databases to reference images of the sky. The imminent release of the Java interface for interactive sky atlas functionalities will soon provide easy access to a powerful identification tool, also allowing easy implementation of future improvements, which will accompany the evolution of the Java language and environment.

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