Access to the Astronomical Literature through the NASA Astrophysics Data System from Developing Countries

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Abstract.
The Astrophysics Data System (ADS) is the search system of choice for Astronomers world-wide. The searchable database contains over 2.6 million searchable records and over two million scanned article pages from about 280,000 articles. The ADS is accessed from almost 130 countries. In order to improve access from different parts of the world, we maintain nine mirror sites of the ADS in Brazil, Chile, China, England, France, Germany, India, Japan, and Russia.

Both the search system and the scanned articles in the ADS can be accessed through email. Email can be used by users that are on slow or unreliable Internet connections. It allows access to the ADS for users who do not have a connection that is good enough to use a web browser.

We are currently in the process of developing a stand-alone ADS system that can run without Internet access in libraries.

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`http://ads.harvard.edu`

1. Introduction

The NASA Astrophysics Data System Abstract Service is by now a central facility of bibliographic research in astronomy. In a typical month (May 2002) it is used by $\sim$60,000 individuals, who make $\sim$1 million queries, retrieve $\sim$40 million bibliographic entries, read $\sim$600,000 abstracts and $\sim$300,000 articles. A more detailed introduction is in Eichhorn et al. (in this volume).

This article will describe features of the ADS that are relevant for users in different parts of the world with different connectivities. This includes a brief description of the system of mirror sites and a description of some of the features that are particularly suited for access from slow or intermittent lines.

2. Mirror Sites

The ADS is available world-wide from 10 sites. Table 1 shows the current ADS mirror sites. You can find the links to the mirror sites from the ADS Homepage.

Table 1.   ADS Mirror Sites.

Country	Mirror Site
USA	Harvard-Smithsonian CfA, Cambridge, MA
France	Centre des Données astronomiques de Strasbourg
Japan	National Astronomical Observatory, Tokyo
Chile	Pontificia Universidad Católica, Santiago
Germany	European Southern Observatory, Garching
Great Britain	University of Nottingham, Nottingham
China	Beijing Astronomical Observatory, Beijing
India	Inter-University Centre for Astron. and Astroph., Pune
Russia	Institute of Astr., Russian Acad. of Sci., Moscow
Brazil	Observatorio Nacional, Rio de Janeiro

If you are interested in having a mirror site, please contact the first author at `gei@cfa.harvard.edu` for detailed requirements.

3.   Using the ADS over slow links

3.1.   Abstract Service queries

The ADS system returns different amounts of information about a reference, depending on what the user request was. The list of references that results from a query is usually a form that can be used for further refinements of the query or for retrieving different formats of the references. However, this requires that additional information needs to be embedded in the results list. The user can choose to retrieve a results list that does not use table formatting and does not include the information for further querying. This reduces the size of the list by about a factor of 2. This is done by setting the user preferences (see section 3.4). A detailed description of these capabilities is in Eichhorn et al. (2000).

3.2.   Full Article Display

The article display normally shows the first page of an article at the selected resolution and quality (see section 3.4). The user can select resolutions of 75, 100, or 150 dots per inch (dpi) and image qualities of 1, 2, 3, or 4 bits of greyscale per pixel (Eichhorn et al. 2000).

The default version for these gif images is 100 dpi, 3 bit greyscale. In order to reduce the amount of data transferred for each page, the resolution can be reduced to 75 dpi, and the image quality can be reduced to 2 or even 1 bits per pixel of greyscale information. The difference in file size between 100 dpi/3 bit and 75 dpi/1 bit is more than a factor of 4. However, the 75 dpi/1 bit pages are hardly readable so the user will have to make a compromise between download speed and readability.

Instead of displaying the first page of an article together with the other retrieval links, the user has the option (selected through the preferences system, see section 3.4) to display thumbnails of all article pages simultaneously. This

allows an overview of the whole article at once. One can easily find specific figures or sections within an article without having to download every page. Each thumbnail image ranges in size from only 700 bytes to 3000 bytes, depending on the user selected thumbnail image quality. The rest of this type of article page is the same as for the page-by-page display option.

3.3.   Email Interface

Email Access to the Search System   The ADS Abstract Service can be accessed through an email interface. This access method may be especially important for users on unreliable links. It will allow access to the ADS that works even if the connection is available only sometimes and/or is very slow. Access through a browser may be impossible, but email will still get through because of automatic retrying of connections.

This service is somewhat difficult to use since it involves an interface between two relatively incompatible interface paradigms. This makes it difficult to describe this interface well. It is intended for users who do not have access to web browsers or have only very unreliable connections. If you have questions about how to use this access, please contact the ADS at ads@cfa.harvard.edu.

To get information about this capability, send email to:

adsquery@cfa.harvard.edu

with the word "help" in the message body. A detailed description of the email access is in Eichhorn et al. (2000).

Email Access to the Scanned Articles   The scanned articles in the ADS can be retrieved via email as well. This can be either set in the user preferences (see section 3.4) or requested from the article display pages under "More Article Retrieval Options".

3.4.   Preferences

The ADS user interface is customized through the use of so-called HTTP persistent cookies. These "cookies" are a means of identifying individual users. Anytime a user makes a request, the ADS software sends a unique string to the browser and asks it to store this string as an identifier for that user. From then on, every time the same user accesses the ADS from that account, the browser sends this cookie back to the ADS server. The ADS software contains a database with a data structure for each cookie that the ADS has issued. The data structure associated with each cookie contains information such as the type of display the user prefers, whether tables should be used to format data, which mirror sites the user prefers for certain external data providers, the preferred printing format for ADS articles, and other information.

The preferences system allows the user to customize the system in order to improve speed over slow links. A more detailed description of the preferences setting system is in Eichhorn et al. (2000).

4.   Usage of the ADS

The ADS is used by a large majority of professional astronomers world-wide on a daily basis, as well as by many other researchers and non-scientists. Most of the usage of the ADS comes from the USA and Europe. Table 2 shows the usage from different regions of the world. It shows that Africa is greatly under represented.

Table 2.   ADS Usage by Region.

Region	Users	Queries	Records retrieved
North America	28365	534271	42208464
Europe	15575	325654	7344539
Asia	4755	79903	2089829
Central and South America	1627	26686	538204
Pacific	1178	14935	346669
Middle East	241	3798	100347
Africa	131	2283	54281

5.   Stand-alone ADS

We are currently in the process of developing a stand-alone ADS system that can be updated through DVDs. This would provide access to the capabilities of the ADS from sites that do not have any Internet access at all. The capacity of hard disk drives is sufficiently large by now to store a complete ADS system on one large disk.

6.   Conclusion

The ADS provides free access to most of the astronomical literature. It has profoundly changed the way astronomers do their research. We hope that it will continue to facilitate astronomical research in particular in countries that do not have easy access to libraries with astronomical literature. We welcome any questions and suggestions on how to improve the ADS services. Please contact us at

<div align="center">

`ads@cfa.harvard.edu`

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References

Eichhorn, G., Accomazzi, A., Grant, C. S., Kurtz, M. J. & Murray, S. S. "Current and Future Holdings of the Historical Literature in the ADS", LISA IV, this volume