CONNECTIVITY IN THE ASTRONOMY DIGITAL LIBRARY THROUGH THE ADS

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Abstract. The Astrophysics Data System (ADS) is an integral part of the Astronomy Digital Library and the collaboration Urania. It provides access to 1 million references and connects these references with many other information centers and their data, such as on-line journals, object databases, and scanned journal articles. This article describes some of the features and links between the ADS and other on-line services.

1. History

Astronomy was always at the forefront of networking technology. With the Astrophysics Data System (ADS) we had a head start in distributed data system. The Classic ADS was the first distributed data system in Astronomy, before the World Wide Web (WWW) became available (Eichhorn, 1994). However, it was based on proprietary technology and therefore never became widely used. When the WWW became popular, the ADS was the first astronomy system to make its services available over the Web (Eichhorn et al., 1995). Other data centers soon followed.

Individual services generally allowed their holdings to be retrieved through specialized query forms, depending on the nature of the data. These ranged from text based queries to the ADS abstract service to queries by astronomical object name in the SIMBAD database to positional queries in catalog databases.

It soon became clear that in order to make these new services really useful, they needed to be connected. One way to connect the different systems is through the published literature. By correlating data sets with the articles in which they were published, it became easy to search for information through natural language queries. This was made possible through the ADS abstract service.

A second way to connect data systems is via object names. This allows the user to find information about specific objects. This type of search was made possible by the SIMBAD database at the Centre de Données astronomiques de Strasbourg in Strasbourg, France (Genova et al., 1997).

By directly connecting to the SMBAD database (and later also to the NASA Extragalactic Database (NED)) and then combining both types of queries in one system, the ADS provided the capability to find published literature for a specified topic or for a specified astronomical object through one system. The published literature in turn was linked to the on-line information at various information centers and to the object databases.

2. Connectivity

The distributed nature of the on-line digital library allows the different information providers to concentrate on their specific tasks, while utilizing the expertise of other systems by directly linking to their on-line information. The ADS provides an easy way for other systems to link to the published literature and, through the ADS links, to other information. The ADS allows other systems to directly link to any of its references or articles. By following a link to an ADS reference, the user then immediately has access to other information linked to this reference. Figure 1 shows

J. Andersen (ed.), Highlights of Astronomy, Volume 11A, 516–519.

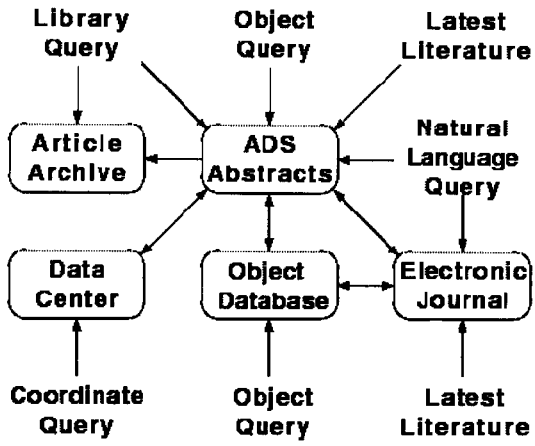

Figure 1. Connectivity in the Astronomy Digital Library.

schematically how interconnected the parts of the astronomy library are and the types of queries that can come in to different parts of the system.

One extremely important property of any on-line system is that it is open to connections from the outside. There are some on-line journals for instance where the user has to log in and then follow internal links to the final article. There is no provision for outside systems to link directly to individual articles in that system. Such closed systems cannot be part of a global digital library since other information providers cannot point to information in these systems directly. It is essential that any information provider who wants to be a part of the global digital library be open to connections from the outside.

3. ADS Query Example

The ADS query page[1] allows users to search the ADS database by author, object name, title, and/or abstract text words. More detailed descriptions of the ADS abstract and article service are available from (Eichhorn et al., 1995), (Accomazzi et al., 1996), (Eichhorn et al., 1996).

TABLE 1. List of data links with anchor letter.

Anchor	Data Item	Data Provider
A	NASA/STI abstract	ADS
C	Citations for current article	ADS
D	Data available	Data centers
E	Electronic on-line article	On-line journals
F	Full text of article (Postscript or PDF)	ADS, on-line journals
I	Author information	ADS
L	Library catalog entry	Library of Congress
M	Mail ordering of articles	Publishers, Service Organizations
N	NED objects	NED
O	Original author abstract	ADS
P	PDS on-line data	Planetary Data System
R	References in article	ADS, on-line journals
S	SIMBAD objects	CDS
T	Table of contents for current volume	ADS

[1]http://adsabs.harvard.edu/abstract_service.html

https://doi.org/10.1017/S1539299600021912 Published online by Cambridge University Press

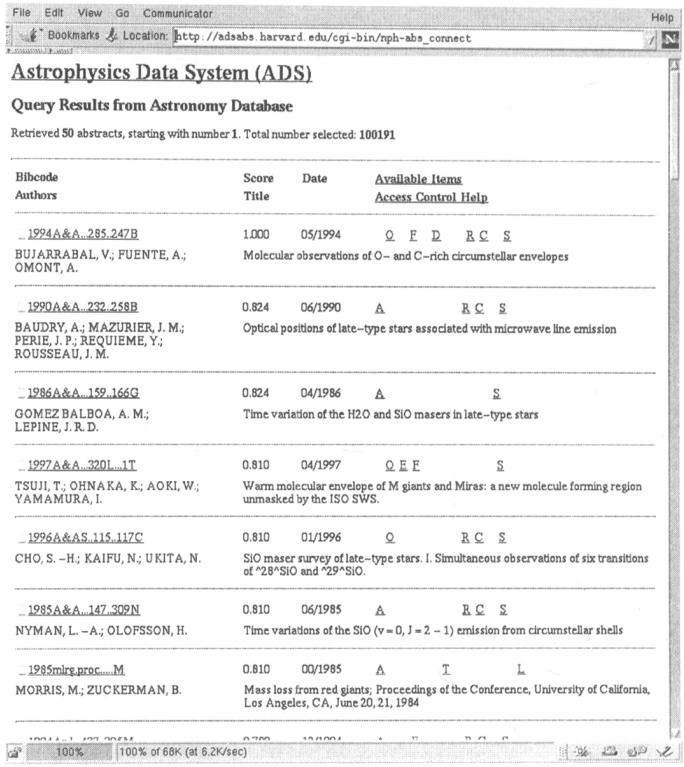

Figure 2. ADS results page.

Figure 2 shows the result of such a query. For each reference, the title, author list, publication date, bibliographic code (see below), and a list of links are returned. The links, anchored on different letters, provide access to additional information for each reference. Table 1 shows the list of possible links and their anchor letters, together with the organizations that have this information on-line. These links are an important part of the ADS and provide the user with the capability to easily move to different sets of information. Most of these links use the bibliographic codes to identify the reference for which the link is specified.

4. Bibcodes

The bibliographic codes (or bibcodes) are by now used by most information systems in astronomy to identify published articles. A first definition of these codes is available from (Schmitz et al., 1995). These bibcodes can be constructed from a regular journal reference. They are 19 digits long and have the following format:

YYYYJJJJJVVVVMPPPPA

YYYY Publication year

JJJJJ Abbreviation for the journal
(e.g. ApJ, AJ, MNRAS, Sci, PASP, etc.)

VVVV Volume number

M To indicate "special" issues
(such as "L" for Letters, "P" for pink pages)

PPPP Page number

A First letter of the first author's surname.

https://doi.org/10.1017/S1539299600021912 Published online by Cambridge University Press

The fields are padded with periods (.) so that the code is always 19 characters long. The journal abbreviation is left-justified and padded right. The volume and page numbers are right-justified and padded left.

New journal abbreviations have to be unique, and follow existing naming conventions. A list of journal abbreviations already in use is available at our website.[2]

A summary of naming conventions is being prepared and will be on-line at the ADS website soon.

The references at the end of this article include the bibliographic codes and hyperlinks to the ADS abstracts in the on-line version. A description of the encoding is available.[3]

5. Conclusion

Linking different systems together is becoming more and more common. There are many new ways available now to connect different information sources. This new way of presenting information is already having a profound influence on how information is made available and how scientists use this information, and it is certain to continue to do so.

6. Acknowledgment

This work is funded by NASA grant NCCW-0024.

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[2]http://adsabs.harvard.edu/abs_doc/journal_abbr.html

[3]http://adsdoc.harvard.edu/abs_doc/bibcodes_help.html