THE MAO NASU GLASS ARCHIVE DATABASE: SEARCH AND MANAGEMENT TOOLS

L. Pakuliak

Main Astronomical Observatory, NAS of Ukraine
27 Akademika Zabolotnoho Str., 03680 Kyiv, Ukraine
e-mail: pakuliak@mao.kiev.ua

At the Main Astronomical Observatory of the National Academy of Sciences of Ukraine (MAO NASU) the astronomical glass archive counts more than 50 000 of plates obtained in various observational projects during last 50 years of the past century. The local single-user database of glass archive, created on the basis of observational logs and partly on measurement results, has been transformed into an online multy-user system to provide a remote access to the plate archive. In the paper online tools for data searching and database management are presented.

INTRODUCTION

At the Main Astronomical Observatory of the National Academy of Sciences of Ukraine (MAO NASU) collected a vast archive of glass astronegatives, obtained in frames of various observational projects, carried out at MAO during last decades. Most of them cover separate sky areas, having interesting astronomical objects, except for more than two thousands FON plates with a full coverage of the northern hemisphere with a small (25%) overlap, as it was provided in Northern Sky Review Project (FON, after the completion of the project and data proceeding – FONAK), carried out in 1987–1994. Time range of the archive covers 50 years (1947–1998). The MAO plate archive started in 1950. The collection was partially presented earlier. Data for some plate collections are shown in Table 1.

Table 1. Some plate collections from the MAO NASU glass archive

Scientific projects	Telescopes	Scale (″/min)	Period	Lim. magn.	Num. of plates
– Galaxies	DLA, DWA, DSA	38, 103, 295	1950–1990	16.0^m, 16.0, 12.0–13.0	1100, 300, 100
– Radio Sources	DAZ, Zeiss-600	69, 28	1986–1989	18.0, 18.5	20, 100
– Selected areas	DWA, DSA, TCA	103, 295, 172	1949–1990	16.0, 14.0, 12.8	400, 2080, 840
Fundamental stars	DLA, DWA	38, 103	1956–1990	14.5, 15.5	1770, 150
Special programs	DLA, DWA, DSA	38, 103, 295	1949–1987	15.5, 16.0, 16.0	2760, 230, 3000
Northern Sky Survey (FON)	DWA, DAZ	103, 60	1981–1993	16.0, 17.0	2400, 90
Planets and their satellites	DLA, DWA, Zeiss-600	38, 103, 28	1960–1990	15.0, 14.0, 16.0	1300, 300, 250
Minor planets	DLA, DWA, DSA	38, 103, 295	1949–1996	14.0, 14.5, 13.0	557, 1100, 20
Comets	DWA, DSA, TCA	103, 295, 172	1976–1996	16.0, 14.0, 12.8	625, 270, 10

List of telescopes in Table 1:
DLA – Double Long-Focus Astrograph ($D/F = 40/550$ refractor);
DWA – Double Wide-Angle Astrograph ($D/F = 40/200$ refractor);
AZT-2 – ($D/F = 70/315$ reflector);
DSA – Double Short-Focus Astrograph ($D/F = 12/70$ refractor);
DAZ – Zeiss Double Astrograph ($D/F = 40/300$ refractor);
TCA – Three-Cameras Astrograph ($D/F = 11/170$ refractor).

Other plate collections include more then 4 000 geostationary satellite plates, 1 000 Moon plates, about 10 000 active solar formation plates, more than 50 000 stellar and planetary spectra plates. During the FON Project observations, it became necessary to create an electronic archive of observed plates and the digital database of plates content on the basis of that archive and measured data obtained after measurements of plates on the measuring machine PARSEC of MAO NASU. Lately that archive was enhanced with data of first epoch plates from others observational projects and the current electronic archive of glass plates was formed.

DATABASE OF THE ASTRONOMICAL GLASS PLATE ARCHIVE

The first version of the electronic plate archive was made in the FOXBASE+ environment on DOS platform. It included data of practically all plates from project FON (FONAK), projects on galaxies, fundamental stars, variable stars, as well as special programs, the MEGA projects, for which the plates have been taken with DLA and DWA (Table 1). The software package consisted of the administrative interface for database integrity support, backup and data correction and of the user interface for the optimal request construction.

On certain stage of plates' digitization, the necessity appeared to transform the local single-user database into an online multy-user system to provide a remote access to the plate archive and to involve the MAO database into the world database of glass archives. And more on, the archive of FON measurements and the conserved measured data of plates of other projects give an opportunity to not only select data of plates, but to obtain a kind of "quick-view" of plate content before the digitization procedure would be completed.

Online astronegative database has been constructed on the basis of the relational database management system MySQL.

MySQL Server was originally developed to handle large databases and today it offers a rich and useful set of functions, making its connectivity, speed, and security highly suited for accessing databases on the Internet. MySQL Server is installed on the web-server (Debian GNU/Linux) of MAO NASU. The MySQL Database Software is a client/server system that consists of a multi-threaded SQL server that supports different backends, several different client programs and libraries, administrative tools, and a wide range of programming interfaces (APIs) and ODBC (Open-DataBase-Connectivity) support for Win32 as well. For non-commercial purposes the MySQL software is an Open Source/Free Software product under the terms of the GNU General Public License.

Currently, the database includes the following plate collections (Table 2):

Table 2. Plate collections, included into the online database

Northern Sky Survey (FON)	2229 records
Sky areas with Galaxies, Radio Sources, Selected areas	1097 records
Fundamental stars	1769 records
Special programs (clusters, star associations, variable stars, double stars, *etc.*)	2091 records
Main Meridional Section of the Galaxy (MEGA)	261 records
Minor planets	1097 records
Comets, clusters, SS bodies (DWAA)	3208 records
Plate collection of Three-Cameras Astrograph (clusters mostly)	1093 records
Plate collection of AZT-2 (70-cm reflector)	1124 records
Total	13969 records

The structure of database (Fig. 1) consists of data tables, connective tables, auxiliary tables and authorization tables. Such a division in according with different functionality permits an easy supplement of database with new collections and a high flexibility in constructing SQL-queries.

General plate data store in data tables divided by instrumental or project factor because of a structure of a record differs widely for different collections (Table 3). Fields set in every data table consists of mandatory fields, the same ones in every collection, and special fields, unique for the collection.

Connective tables include data, which describe common characteristics of instruments, programs, emulsions, *etc.*, as well as identificator fields for binding common data with data of every collection.

The auxiliary table "list of fields" includes the description of every data table structure and is necessary for the formalization of SQL-queries when searching of data. The table of authorization includes data of permitted users and their personal information in order to give the access for the administrative part of the database user interface.

The electronic database of the plate data archive is searchable. The search engine for data search was built on PHP+MySQL web facilities and for the moment it is capable to search plates in the area of any radius around the point with center coordinates, telescope, collection, colour band, exposition duration, period of observation, *etc.*, inserted into the SQL-query constructor form as search parameters. The result of searching returns as a HTML-page with general data of selected plates, covering the area of interest. It is possible to search data as in a separate collection, and so as in the whole database.

The user interface permits user to browse detailed plate data for every plate, identified by its log-book name, to browse a complete set of plate data for the collection as a whole and to view the overall description of collections.

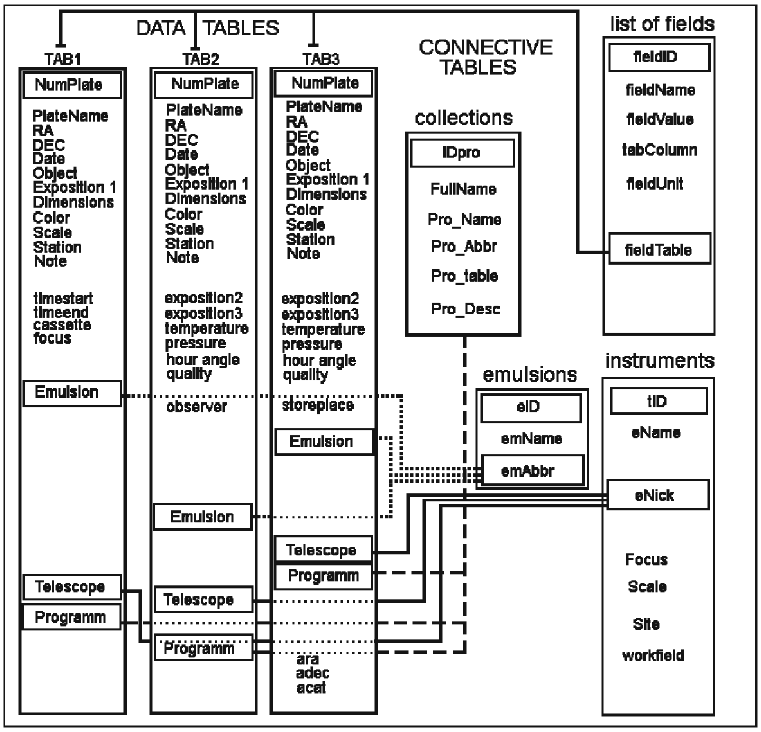

Figure 1. The structure of database

Table 3. An example of MySQL-table structure for the MEGA observational project

No	Field	Type	Default	Extra	Index	Field Description
1	NumPlate	Int(10)	Default	Autoincrement	Primary	Plate ID
2	PlateName	Varchar(12)	0			Number of plate in a log
3	RA	Double	NULL			Center coordinates
4	D	Double	NULL			Center coordinates
5	EPlate	Int(10)	0			Epoch of center coordinates
6	LimMag	Int(10)	0			Limited magnitude
7	DPlate	Int (10)	0			Date
8	Obj	Varchar(50)	0			Astronomical objects
9	XNum	Tinyint(4)	0			Number of expositions
10	X1	Float	0			Duration of 1st exposure
11	X2	Float	0			Duration of 2nd exposure
12	X3	Float	0			Duration of 3rd exposure
13	DimP	Varchar(20)				Dimensions
14	Temp	Float	0			Temperature
15	Press	Float	0			Pressure
16	TAngle	Float	0			Hour angle
17	Qual	Varchar(20)				Quality
18	Emulsion	Varchar(20)	NULL			Emulsion and filter
19	Colour	Varchar(4)	NULL			Colour
20	Observer	Varchar(20)				Observer
21	Note	Text				Notes
22	Telescope	Varchar(100)	NULL			Telescope
23	Scale	Int(11)	0			Scale
24	Program	Varchar(255)	NULL			Observational project
25	Station	Varchar(255)	NULL			Observational site
26	Digitals	Varchar(255)	NULL			Scan index or measurements file index
27	Tstamp	Timestamp(14)	NULL			Timestamp

The administrative module of the user interface gives a possibility to update data in records of every data table or to add single plates to the proper collection. Massive data loading or creation of new data tables is carried out by means of MySQL environment, not through the user interface. An access to administrative tools of user interface is realized by means of PHP Basic Authentication and is permitted for authorized users only.

The database is available on the web-site of the Main Astronomical Observatory of NAS of Ukraine at [`http://www.mao.kiev.ua/ardb/`].

PROSPECTS

The further development of user package of tools for database management and data search include following tasks (in the order of complexity growing):

1. Realization of building of sketches of selected plates overlapping.
2. Improvement of the database expansion tools by means of WWW-interface.
3. Realization of data extracting in various output formats; dumping selected data into files and transmission them into the user computer by HTTP or email (in a case of a vast data set).
4. Realization of "quick-view" of plate content on the basis of plate scanning or measurements.

[1] *Pakulyak L. K., Golovnya V. V., Sergeeva T. P.* Wide Field Plate Archive of MAO NAS of Ukraine: electronic plate collection and first results of database application // New deal in European Astronomy: Trends and Perspectives: Abstr. Intern. Conf. JENAM-2003, Budapest, Aug. 25–30, 2003.–P. 112.