Astronomical Data Analysis Software and Systems X
ASP Conference Series, Vol. 238, 2001
F. R. Harnden Jr., F. A. Primini, and H. E. Payne, eds.

The Uccle Direct Astronomical Plate Archive Centre UDAPAC—A New International Facility for Inherited Observations

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Abstract. An international facility to store, catalogue and digitise photographic plates is under development at the Royal Observatory of Belgium in Uccle-Brussels. The creation of such a facility requires a well-organized effort and substantial resources. However, the cost is not exorbitantly high if one takes advantage of the new generation of commercial, photogrammetric, flatbed scanners, which use the latest CCD technology. These scanners are relatively inexpensive, very fast, and comparable to dedicated scanners like PDS instruments in geometric and radiometric precision.

1. Goals and Objectives

The international workshop *"A European Plate Centre"* took place in March 2000 at the Royal Observatory of Belgium in Uccle (ROB), one year after the international workshop *"Treasure Hunting in Astronomical Plate Archives"*, held at Sonneberg Observatory, Germany (Kroll, la Dous, & Bräuer 1999; la Dous 1999). At the ROB workshop, it was decided to attempt to create, within 5 years,

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a scientifically useful digital archive, based on observations selected from half a million photographic plates to be stored at the ROB in Uccle. More information on the project is available at the UDAPAC web site `http://udapac.oma.be`.

2. Scientific Rationale

Many astronomical objects are exhibit either secular changes (e.g., proper motions, stellar evolution), periodic variability (e.g., binaries), or repeated outbursts at irregular intervals (e.g., novae). Many changes take place on timescales that are too long to be covered at all adequately by modern observing, however sophisticated the equipment. Innumerable questions—concerning, for instance, long-term trends in dynamical and astrophysical evolution, pre-outburst conditions of cataclysmic events, apsidal motion, or the causes of newly-discovered stellar variability of a longer period and larger amplitude than previously suspected—can only be answered by examining archival material that spans many decades. The preservation of past records is therefore vital to this science. User-friendly digital archives are an essential research tool to complement modern observations.

The world's collection of photographic images represents the costly output from more than a century of devotion and skill. The collection is already nominally in the public domain, but as a universal resource it is seriously under-exploited. The main reasons are : (a) lack of information in digital form about the plates, and (b) lack of digital versions of the observations.

The astronomical community itself must be responsible for creating a user-friendly on-line database of calibrated digital images from this resource. The creation of such a database requires a well-organized effort and substantial, but not exorbitantly high, resources.

3. Existing Situation

The locations and contents of most of the relevant photographic archives are already documented in the *Catalogue of Wide-Field Plate Archives* (Tsvetkov 2000)[2]. That facility is an essential first step in locating the plates needed for a given task, such as multi-scale analyses of specific targets.

Although most plate archives are now 'closed', i.e., no-one is actively in charge and there are no regular loan arrangements, all have log-books and card-catalogues which contain the relevant information about the exposures. A few observing logs are already on-line.

Some observatories (particularly ESO and to a lesser extent Kitt Peak) did not routinely request observers to return their plates. Consequently much of the plate collection remains widely dispersed even though it is no longer needed by the original observers.

Commercial photogrammetric scanners are now relatively low-cost, and are capable of precise geometric and radiometric performances that make them com-

[2] `http://www.skyarchive.org/catalogue.html`

petitive with PDS instruments, especially since the archive will include plates of a wide range of size, quality and accuracy.

4. Strategies to Achieve the Goals and Objectives

The main goal is to create a unique resource for scientific research that exploits the long time-base of these archived astronomical observations. The proposed astronomical data centre at the ROB will safeguard a substantial fraction (about 25%) of astronomy's total heritage of direct photographic observations in the world, and will undertake the digitization and processing of a wide selection of particularly time-sensitive observations. The group has identified a number of key project tasks whose completion constitute stepping-stones towards the main goal. These are outlined below.

4.1. Storage Conditions

The appropriate control of humidity and temperature is to be planned and costed with expert advice. New plate envelopes might be needed for some collections.

4.2. Rapid Key Projects

A small sub-set of research projects, that can be executed relatively quickly from new scans of old plates, is needed in order to demonstrate convincingly the soundness of the project and thence to attract funding to establish it firmly. Each scientific project must be able to compete on merit in the post-photographic age, with time variability as one of the fundamental features. Particular emphasis is to be placed on the complementarity of the archival material, and links with modern high-cost projects are to be explored. As far as possible, scientific proposals should link to research programmes at the host observatory (ROB). They must also promote innovative ideas for using an archive as a central research tool. Plate archives with contents suitable for rapid key projects are to be identified as ready for immediate transfer.

4.3. Comprehensiveness of Plate Survey

The WFPA list is to be completed, by determining which plate stores can be sent and which are still in active use, together with a list of declarations of intent.

Observatory directors or custodians of plate archives will be invited to consider donating redundant equipment, and to participate in the transport responsibilities. A worldwide request is to be issued for plates in individual collections to be returned for optimal conservation and/or digitization.

4.4. Scanner Selection

Test plates are to be circulated to commercial scanners to evaluate their adequacy for this project, with parallel tests run on special-purpose scanners (e.g., at Sonneberg, Cambridge, Edinburgh). Commercial photogrammetric scanners prove to be very fast (8–20 min for a $10'' \times 10''$plate at $15\,\mu$m pixel size) and of enough geometric and radiometric precision to make them cheaper alternatives to the special-purpose machines. A full evaluation of their accuracy, repeatability and stability is taking place.

4.5. Archive Software

Adequate indexing of content, quality and other details is essential for the development of an automatic request scheme for scans of located plates. Existing query software is to be adapted as far as possible. The database must provide the data in a standard format such as FITS, and must employ efficient and suitable means of data compression.

Existing scanner related software from other domains like areal photography and electron microscopy can be used to build a user-friendly, fully documented database.

4.6. Funding

Support is to be sought for specific facets of the project, such as :

1. travel for scientific visits and meetings;
2. outside consultants;
3. hardware: refurbishment, shipping, instruments, office equipment;
4. manual tasks suitable for casual employment;
5. preservation of historic scientific material;
6. a "virtual observatory" and public archive resource for research;
7. a set of scientific projects at the cutting edge of modern science.

Acknowledgments. J.-P. De Cuyper carried out this research in the framework of the project "IUAP P4/05" financed by the Belgian Federal Scientific Services (DWTC/SSTC).

References

la Dous, C. 1999, wgss_newsletter 11, 26, `http://www.skyarchive.org/wgss_newsletter`

Kroll, P., la Dous, C., & Bräuer, H.-J. (eds.) 1999, 'Treasure-Hunting in Astronomical Plate Archives', Proceedings of the international workshop held at Sonneberg Observatory March 4-6, 1999, Historica Astronomiae, 6, (Verlag Harri Deutsch, Thun und Frankfurt am Main)

Tsvetkov, M. 2000, Catalogue of Wide-Field Plate Archives, Sky Archive Data Center, Institute of Astronomy, Sofia, Bulgaria, `http://www.skyarchive.org`