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# ARCHIVING OF THE POTSDAM WIDE-FIELD PHOTOGRAPHIC OBSERVATIONS

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**Abstract.** The inventory of the wide-field plate archives stored in the Astrophysical Institute Potsdam since 1879 is presented. The whole Potsdam plate collection consists of 11 wide-field plate archives obtained in the period 1879 – 1970 (see Catalogue of Wide-Field Plate Archives, version 5.0, March 2004, `http://www.skyarchive.org`) with about 10 000 plates stored not only in Potsdam but in Leiden and Sonneberg, too. The plates contain valuable astronomical information easily to be retrieved. The Potsdam wide-field plate collection reflects also the history and development of the Potsdam Observatory.

## 1. INTRODUCTION

The archived astronomical wide-field photographic observations are now a part of the existing virtual observatories world-wide. Their importance results from the chance to follow certain astronomical objects with definite coverage in time and space. The possibilities for a quick plate digitization now and the on-line access to the plate information have increased the re-usage of the archived observations. Information about the wide-field photographic archives and their contents can be found in the Wide-Field Plate Database (WFPDB), installed in Strasbourg (`http://vizier.u-strasbg.fr/cats/VI.htx`) and its updated version in Sofia (`http://www.skyarchive.org/`). Many observatories possessing such archives like Asiago Observatory, Royal Observatory of Belgium, Rozhen Observatory, Institute of Astronomy in Cambridge, David Dunlap Observatory, Bamberg Observatory, Royal Observatory Edinburgh, Harvard College Observatory, Maria Mitchell Observatory, Sonneberg Observatory, Midi-Pyrenees Observatory, Valencia Observatory, Main Astronomical Observatory Kiev, etc. have started the execution of projects for scanning of the archival plates.

The accumulated wide-field photographic observations in the Astrophysical Institute Potsdam (AIP) have made well known contributions not only to astronomy, but also to the development of photography itself since the end of the 19th century. In this context we remember many observers from Potsdam like e.g. O. Lohse (since the foundation of the observatory), J. Scheiner (the end of 19th century), J. Hartmann (the beginning of 20th century), E. Hertzsprung and K. Schwarzschild (the 10s of 20th century), G. Eberhard (the 20s and 30s of 20th century). Practically, the Potsdam Observatory was the base for testing new astronomical emulsions, beginning with the dry photographic plates of Schleussner (produced in Frankfurt), to AGFA Enterprise up to 1960 and ORWO after 1960.

The process of archiving the wide-field photographic observations comprises such steps as making of an inventory of the plate collection, preparation of computer-readable versions of the plate catalogues, plate digitization and providing of good storage with suitable temperature, humidity free conditions and easy access to the plates and to the plate digitized information. Here we present this process, running in the AIP.

## 2. INVENTORY OF THE AIP ARCHIVES

The wide-field plate collection in AIP dates since 1879 when the Astrophysical Observatory Potsdam was put in operation. The beginning of the collection is connected with the name of Oswald Lohse – Haupt-Observator in Potsdam at that time. The wide-field photographic observations, obtained in the period 1879 – 1970, are separated in 11 archives according to the instrument with which they are made. The total number of plates and films in these archives is about 10 000 (including the plates stored in Leiden and Sonneberg).

The plate collection has been stored under relatively good conditions (having in mind such practical problems like humidity, dust, strong illumination, and optimal room temperature) in the building of the Great Refractor (Telegrafenberg), as well as in the new AIP library in Babelsberg (former dome of the 1.22 m telescope) for the archives of Lohse and both Schmidt telescopes.

Table 1 presents an excerpt from the Catalogue of Wide-Field Plate Archives (CWFPA, version 5.0, March 2004, URL: `http://www.skyarchive.org`) and gives some data for the Potsdam Observatory instruments for wide-field photographic observations, as follows: the WFPDB instrument identifier, the main instrument characteristics (type, location, clear aperture, focal length, scale, field size), the years of operation and the number of obtained plates/films. The WFPDB instrument identifier consists of a 3-letter abbreviation of the name of the observatory/institute and the aperture of the telescope in cm. In case of instruments with the same aperture in the same observatory a suffix A, B, C, etc. is added.

## 3. POTSDAM WIDE-FIELD PLATE ARCHIVES

### 3.1. THE LOHSE ARCHIVES (POT013B AND POT030A)

The archives contain observations since 1879. According to Lohse's logbook (fortunately found in the library), 217 plates are obtained with the refractor of 30 cm diameter, focal length of 5.4 m, and $38''$/mm scale. The manufacturer of the optics

**Table 1:** Potsdam Observatory Wide-Field Instruments

| WFPDB Instrument Identifier | Type | Location[1] | Clear Aperture [m] | Focal Length [m] | Scale [″/mm] | Field Size [°] | Years of Operation | Number of Plates or Films |
|---|---|---|---|---|---|---|---|---|
| POT013A[2] | Rfr | T | 0.13 | 2.10 | 98 | | 1879-1908 | |
| POT013B | Rfr | T | 0.13 | 1.36 | 152 | 5.0 | 1888-1889 | 15 |
| POT015[3] | Cam | T | 0.15 | 1.50 | 137 | 7.6 | 1908-1948 | 3000 |
| POT020[4] | Rfr | T | 0.20 | 3.40 | 61 | 1.5 | 1879-1908 | |
| POT025 | Sch | T | 0.25/0.30 | 0.75 | 275 | 6.8 | 1949-1967 | 405 |
| POT030A | Rfr | T | 0.30 | 5.40 | 38 | 1.2 | 1879-1930 | 88 |
| POT030B | Rfl | T | 0.30 | 0.90 | 229 | | 1906-1930 | 1500 |
| POT032 | Rfr | T | 0.32 | 3.40 | 61 | 2.7 | 1889-1920 | 3000: |
| POT040A | Rfr | B | 0.40 | 5.50 | 38 | 1.7 | 1917-1938 | 1436 |
| POT040B[5] | Rfl | T | 0.40 | 0.90 | 229 | | 1932-1948 | |
| POT050 | Sch | T | 0.50/0.70 | 1.72 | 122 | 4.5 | 1952-1970 | 507 |

Notes: [1] T – Telegrafenberg, B – Babelsberg. [2] A Steinheil refractor with a tripod manufactured by Pistor and Martin. [3] In 1932 this Zeiss triplet was provided with the 17 cm photovisual objective with 1.20 m focal length. [4] The manufacturer is H. Grubb. In 1908 the Grubb refractor was provided with the 30 cm Steinheil objective for visual photometry of stars. [5] The mirror is parabolic.

was H. Schröder and for the mechanics – A. Repsold. This refractor was called "the Great Refractor" in the period 1879 – 1899 (after 1899 the name "Great Refractor" was ascribed to the new 80 cm refractor, then put in operation). Since 1888 Lohse had sometimes mounted two heliographic objectives with a diameter of 0.13 cm (the first one with 2.1 m focal length, 98″/mm scale, and the second one with 1.36 m focal length, 152″/mm scale, and 5° field size) on the refractor. Lohse's archives made with this telescope and with the attached second heliographic objective are only partly identified till now. They are presented in Tsvetkov et al. (1999a,b).

### 3.2. THE POTSDAM ZONE CARTE DU CIEL ARCHIVE (POT032)

The Astrographic Catalogue (AC), also known as Carte du Ciel (CdC), was a massive program started in 1887 by 22 observatories with the aim to photograph and measure positions for stars to magnitude $B = 12.5$. The resulting observatory catalogues contain rectangular coordinates of varying precision for over 4.5 million stars, spanning a very wide range of epochs around the average near 1905. These positions, now in computer-readable form, have been reduced to equatorial coordinates nominally in the Hipparcos (ICRS, J2000) system. One of several completed versions is the AC2000. The deep CdC plates with one exposure of 80 min are supposed to be the deepest sky survey available at the end of the 19th century.

The Potsdam Zone of CdC (dec. +31° to +40°) was observed with the double refractor containing one 32 cm photographic objective and one 24 cm visual objective of the manufacturers Steinheil and Repsold. Later on the 32 cm double refractor was replaced by a mirror telescope for spectrographic observations.

The Potsdam CdC archive, containing about 3000 plates, is especially important having in view the started digitization of CdC plates: Cordoba Zone by the UMAX Astra 1220P flatbed scanner (1028 scanned plates, Calderon et al. 2002), Vatican (540 scanned plates, Barbieri et al. 2003), Bordeaux Zone (+11° to +18°) (about 530 scanned plates, Argyle 2002), Sydney Zone (−52° to −64°) (about 360 scanned

plates, Argyle 2002). Plates from the Catania Zone (+47° to +54°), Algiers Zone (+4° to −2°), Brussels and Toulouse have been scanned, too.

Already Fresneau et al. (2001, 2003) made repeated usage of the triple exposure CdC plates and revealed significant opportunities for the detection of flare stars.

### 3.3. THE HERTZSPRUNG ARCHIVES (POT015, POT030A, AND POT040A)

Some of the Potsdam plates were found by us in Leiden Observatory stored in excellent conditions. These are the plates of Hertzsprung who worked in the Potsdam Observatory from 1909 to 1919 as an observer and moved to Leiden later. A big part of the found Hertzsprung plates - about 460 plates, were obtained with the 15/150 cm Zeiss Triplet located in Telegrafenberg (POT015). The 15/150 cm Zeiss was installed mainly for photographic photometry (Hassenstein, 1941). Another part of the Hertzsprung archive according to the logbook found in Leiden was obtained with the 30/540 cm telescope (POT030A, 36 plates) and the 40 cm Toepfer telescope (POT040A) located in Babelsberg.

### 3.4. THE 30/90 CM STEINHEIL-SCHMIDT (POT030B) ARCHIVE

The 30/90 cm telescope with the Steinheil objective was installed in 1905 in the west dome of the main building on Telegrafenberg to replace the Grubb refractor. O. Lohse was one of the first observers in January 1905. From October 1905 till February 1906 Bernhard Schmidt mounted on this telescope his 42 cm mirror with a focal lenght of 97 cm and the observatory staff observed obviously with it during Schmidt's work on the Steinheil objective improving. The Steinheil objective was corrected by Schmidt and since March 1906 the observations had been continued by the so called Steinheil-Schmidt optic telescope till October 1930. We found a log book containing information about 1500 plates.

### 3.5. THE 40 CM REFLECTOR (POT040A) ARCHIVE

The 40 cm reflector located in Babelsberg began its work in 1917. The plates were moved to Sonneberg in order to be re-used in the period of unification of Potsdam and Sonneberg observatories and now are stored there.

### 3.6. THE BIG SCHMIDT TELESCOPE (POT050) ARCHIVE

The archive contains information for 507 plates obtained in the period 1952 – 1970. The logbook was not found. The first observations (1952) suffered by the mirror astigmatisms and pillar vibrations caused by a nearby railway and the conducted seismographic investigations in Telegrafenberg. Test observations for suitability for spectral and luminosity classification with objective prism spectra with small dispersion (800 Å/mm at H$\gamma$), were done during that period. In 1955 the mirror of the telescope was covered with aluminum and Zeiss Jena made a new correcting plate (1957). The telescope was used for direct or objective prism observations of occasional comets (1956h Arend-Roland, 1957d Mrkos, 1962c Seki-Lines, 1961e Humason). Numerous technical plates were made with the telescope for tests of the technical condition of the telescope, as well as for some technical improvements.

In 1979 the telescope was moved to the Bulgarian National Astronomical Observatory Rozhen as a gift of the Academy of Sciences of DDR to the Bulgarian Academy of Sciences and has been operated since that time by the Rozhen Observatory as a main wide-field instrument.

A special designation system for denoting of the plate serial number on the Big Schmidt telescope plate envelope was used, e.g. S1-007 FOO. S1 stands for the Big Schmidt telescope plates followed by the serial plate number. The last three capital letters were given for quick classification of the plates. The first letter denotes the purpose of the observation: F – for focusing, V – for test plate (from the German "Versuch"), S – for observation of star, N – for nebula, H – for cluster (from "Haufen"), K – for comet ("Komet"), P – small planet, M – Moon. The second letter concerns the use of a filter (with or without). Usually the letters O (stands for "Ohne" – without) and M ("mit" – with) – are used. The third letter stands for method of observation: O for objective (direct) plate, P – for prism, B – not clear to us, H – Hartmann test, R – reflex test picture, Z – for establishment of time scale ("Zeit"), G – not clear to us.[1]

### 3.7. THE SMALL SCHMIDT TELESCOPE (POT025) ARCHIVE

For the 0.25/0.30 m Schmidt telescope photographic emulsions coated on a glass (291 plates) and film base (119 observations) were used. The telescope was combined with an 8° objective prism with 280 mm diameter. With this telescope mainly spectrophotometric observations of the eclipsing binaries (AR Aur, VV Cep, Zeta Aur, AZ Cas, RS Oph) and comets (Pflug 1967)[2] were made.

The observers identified each plate by a special number, which reflected the observation method used. The designation for observation made on glass is e.g. SP008(S). SP stands for the (S)chmidt telescope (P)late, followed by the serial plate number and in brackets one of the three capital letters (S, V or F). S stands for real observation, usually (S)tar, V – for test observation, F – for focusing.

The designation for observation made on film is e.g. SF012(F). SF stands for the (S)chmidt telescope (F)ilm, followed by the serial plate number. In the brackets one of five letters was used: S – for Star observation, V – for Test plate, F – for Focus plate, H – for Cluster observed, K – for Comet.

## 4. MAIN OBSERVATIONAL PROGRAMS OF WIDE-FIELD PHOTOGRAPHIC OBSERVATIONS

The main observational programs of the wide-field photographic observations in Potsdam Observatory can be summarized as follows:

– Potsdam Survey of North BD Stars up to 7.5 mag

[1] One can meet a similar designation system later in the Palomar catalogue for the POSS II plates in a simpler form (only two letters used): first letter – S for survey plates, F for focus plates, T for test plates, U for USNO plates and P for different from survey plates; the second letter is used as a rule for designation of the emulsion type.

[2] The work of Pflug (1967) on the comet 1956h Arend-Roland is based on 16 plates. 14 of them are missing in the archive, probably still being kept by the observer.

(G. Müller and P. Kempf, 1886 – 1906)
– Continuation of Potsdam Survey for Weak BD Stars in the Polar Zone
(G. Müller, E. Kron and A. Kohlschütter, 1907 – 1920)
– Potsdam CdC Zone (dec. +31° to +40°)
(J. Scheiner, A. Biehl, O. Birck, 1883 – 1921)
– Photographic Photometry
(J. Scheiner, 1888 – 1891; E. Hertzsprung in the Pleiades and Praesepe, 1912 – 1918)
– Investigations of Double Stars
(J. Scheiner, 1908; E. Hertzsprung, 1914 – 1921; W. Münch, up to 1937)
– Application of Objective Prisms
(E. Hertzsprung, W. Münch, 1910 – 1927)
– Investigations of Dark Nebulae and Stellar Photometry in 115 Southern Kapteyn Selected Areas – the expedition to Bolivia (1928 – 1929)
– Investigations of Mira Type Stars
(R. Müller, 1933 – 1936)
– Investigations of Open Stellar Clusters
(W. Becker, 1935 – 1939)
– Investigations of Eclipsing Binary Stars
(K. Walter, 1937 – 1939)
– Investigations of Comets and Small Planets (up to 1970).

It is seen from the above summary that the Potsdam wide-field plate collection reflects the history and development of the Potsdam Observatory.

## 5. CONCLUSIONS

As a result of the inventory of the AIP wide-field photographic observations 11 archives obtained in the Potsdam Observatory in the period 1879 – 1970 were included in the Catalogue of Wide-Field Plate Archives. According to this catalogue (version 5.0, March 2004) one of the oldest plate archives in the world made by the former "Potsdamer Haupt-Observator" Oswald Lohse is partly stored in Potsdam. The AIP plate collection, accumulated as a result of different observational programs, contains about 10 000 plates (stored in Potsdam, Leiden and Sonneberg), and reflects the history and development of the Potsdam Observatory. The preservation of this scientific heritage through digitization of the observations is an important task for the future.

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