



Leibniz-Institut für
Astrophysik Potsdam

Comets in digital plate archives on the example of APPLAUSE database

Sergei Schmalz (AIP), 07.06.2015
European comet conference – Ondřejov 2015
(Czech Republic)

Outline:

- Astronomical plate archives / databases
- APPLAUSE database
- Cometary data in APPLAUSE
- Cometary data worldwide – how to?
- Application



Astronomical plate archives / databases

- Time scale: from 1870s till 1980s
- Worldwide estimate: 7 millions of plates / films (Hudec 2014)
- Archives: > 42 countries with > 68 archives
 - Harvard (500.000) – Sonneberg (300.000)
 - Mayaki (150.000) etc.
- Online-Archives:
 - DASCH (Harvard)
 - WFPDB (Sofia)
 - etc. etc. etc.

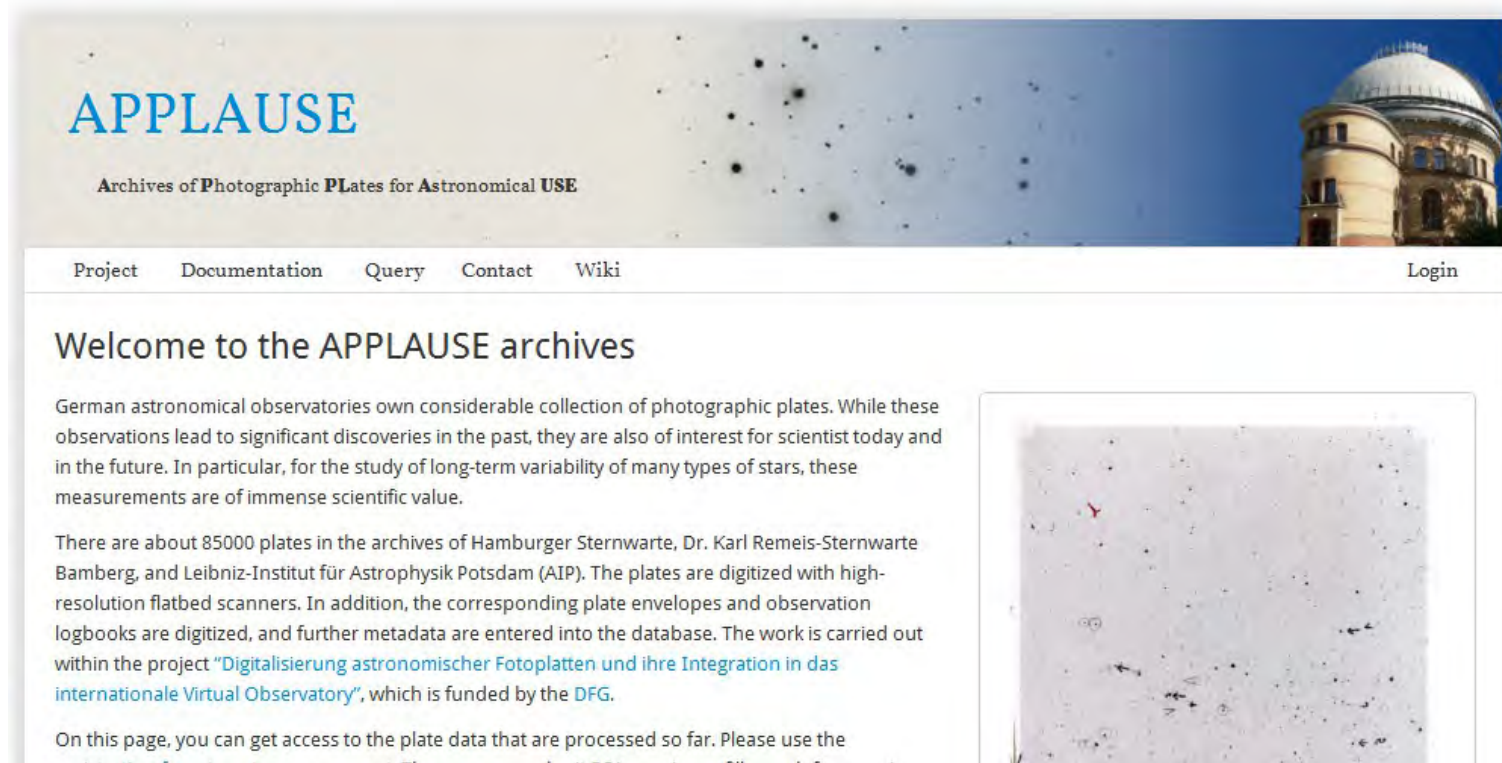
APPLAUSE: Database overview

- General facts
- Database framework: Daiquiri
- Database structure
- Current status: DR1
- Future plans: DR2 & next project
- Usage: SQL & cone search

APPLAUSE: Database overview

- General facts:

www.plate-archive.org



APPLAUSE
Archives of Photographic **PL**ates for Astronomical **USE**


Project Documentation Query Contact Wiki Login

Welcome to the APPLAUSE archives

German astronomical observatories own considerable collection of photographic plates. While these observations lead to significant discoveries in the past, they are also of interest for scientist today and in the future. In particular, for the study of long-term variability of many types of stars, these measurements are of immense scientific value.

There are about 85000 plates in the archives of Hamburger Sternwarte, Dr. Karl Remeis-Sternwarte Bamberg, and Leibniz-Institut für Astrophysik Potsdam (AIP). The plates are digitized with high-resolution flatbed scanners. In addition, the corresponding plate envelopes and observation logbooks are digitized, and further metadata are entered into the database. The work is carried out within the project [“Digitalisierung astronomischer Fotoplatten und ihre Integration in das internationale Virtual Observatory”](#), which is funded by the [DFG](#).

On this page, you can get access to the plate data that are processed so far. Please use the



APPLAUSE: Database overview

- General facts:

APPLAUSE: **A**rchives of **P**hotographic **P**Lates for **A**stronomical **U**SE;

2012 – 2015: collaboration of Bamberg, Hamburg, Potsdam and Tartu Observatories;

estimated total potential: **85.000 plates**;

preliminary work: collaboration with the **WFPDB** (Milcho Tsvetkov & Co, Sofia);

data processing software: **PyPlate** (open source).

APPLAUSE: Database overview

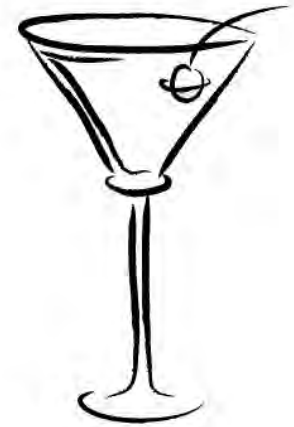
- Database framework: **Daiquiri**

features:

- VO compliant
- customizable data query forms
- user management / messaging
- SQL query interface
- WordPress integration
- in-browser plotting, etc., etc.

get it (open source): escience.aip.de/daiquiri

also used for: **CosmoSim, Gaia@AIP, RAVE.**



APPLAUSE: Database overview

- Database structure: **13 tables**

- *archive*: data on plate archives
- *exposure*: exposures on plates (date, time, etc.)
- *healpix*: HEALPix centers
- *logbook*: logbooks / observer notebooks
- *logpage*: logbook pages, plate envelopes
- *plate*: plate metadata (emulsion, etc.)
- *plate_logpages*: associations of plates with logpages
- *process*: data on processing
- *raw_lightcurve*: raw magnitudes
- *scan*: high-res plate images
- *solution*: astrometric solution
- *source*: raw data on extracted sources
- *source_calib*: calibrated data on extracted sources

APPLAUSE: Database overview

- Current status:

DR1 published on April 24, 2015 includes:

4 archives with 25612 high-res 2400 dpi scans as FITS, low-res previews as JPEG or PNG, 19335 plates, 1.66 billion extracted sources, 26526 JPEG images of plate covers and logbook pages, 77 logbooks, 17 TB total size of the published files;

astrometric solutions: derived on the basis of the UCAC4, 837 million sources with matched UCAC4 designations and 111 million sources with Tycho-2 designations;

photometric data: only raw extracted magnitudes and fluxes by the SExtractor, no photometric calibration of any kind at this stage.

APPLAUSE: Database overview

- Future plans:

DR2 (this year):

photometric calibration.

Next 3-year project (IF approved!):

Tartu / Tautenburg / Jena plate archives (add ~ 11.500 plates);

astrometric reduction of multiple-exposure plates;

extraction and calibration of spectra;

flagging of artefacts => candidates for Solar system objects.

APPLAUSE: Database overview

- Usage: SQL search: database browser (tables, columns)

DATABASE STATUS

There is no job in the queue.
You are using 0 byte of your quota of 1.5GB.

NEW QUERY

SQL query
Plate cone search
Raw light curve by star ID

JOB LIST

New Query

SQL query

Place your SQL statement directly in the text area below and submit your request using the button.

Database browser Function browser Examples

| DATABASES | TABLES | COLUMNS |
|------------------------|--------------|------------------|
| APPLAUSE_DR1 | archive | archive_id |
| applause | exposure | archive_name |
| plates_user_sergiuspro | exposure_sub | institute |
| | healpix | timestamp_insert |
| | logbook | timestamp_update |

A double click will paste the database/table/column identifier into the query field.

```
1 |
```

APPLAUSE: Database overview

- Usage: SQL search: function browser (SQL keywords, functions)

The screenshot displays the APPLAUSE database interface. On the left, there are three panels: 'DATABASE STATUS' with a message about job queue and quota, 'NEW QUERY' with a list of queries including 'SQL query' (highlighted), and 'JOB LIST'. The main area is titled 'New Query' and contains an 'SQL query' section with instructions to place SQL statements in a text area. Below this, there are three tabs: 'Database browser', 'Function browser' (selected), and 'Examples'. The 'Function browser' is divided into three columns: 'KEYWORDS' (SELECT, SELECT DISTINCT, FROM, WHERE, AND), 'BASIC FUNCTIONS' (AVG, COUNT, SUM, MAX, MIN), and 'ADVANCED FUNCTIONS' (angdist). A note states 'A double click will paste the function into the query field.' At the bottom, a text area for the query is shown with the number '1' in the first line.

APPLAUSE: Database overview

- Usage: cone search (RA, Dec, radius)

DATABASE STATUS

There is no job in the queue.
You are using 0 byte of your quota of 1.5GB.

NEW QUERY

SQL query

Plate cone search

Raw light curve by star ID

JOB LIST

New Query

Plate cone search

Please specify a coordinate in right ascension (RA) and declination (DEC). The query will result in plates that have center coordinates in the search cone.

RA_{deg}

DEC_{deg}

Radius_{deg}

Name of the new table (optional)

Submit new plate cone search

Short queue Long queue

APPLAUSE: Acknowledgments

- **Funded by DFG:** Digitization of astronomical photographic plates and their integration in the international Virtual Observatory
- **Bamberg:** Ulrich Heber, Heinz Edelman, Norbert Jansen, Horst Drechsel, Jörn Wilms, Ingo Kreykenbohm, et al.
- **Hamburg:** Detlef Groote, Norbert Engelhardt, Dieter Engels, Anette Müller, Kersten Polzin, Sven Preller, Anke Vollersen, André Wulff
- **Potsdam:** Harry Enke (PI), Jochen Klar, Kristin Riebe, Adrian Partl, et al.
- **Tartu:** Taavi Tuvikene (PyPlate)

Cometary data in APPLAUSE

- Bamberg: none in DR1, but ...
- Hamburg: a lot!
- Potsdam: many

- Tartu: expected (a lot!)

- Jena: expected (unknown)
- Tautenburg: expected (unknown)

Cometary data in APPLAUSE

- **Hamburg: just a lot!**

Gale 1912a

Delavan 1912d

Kritzinger 1914a

Zlatinsky 1914b

Mellish 1915a

Taylor 1915e

Neujmin 1916a

Kopff 1919a

Brosen-Metcalf 1919b

Metcalf 1919c

Schain 1925a

Tempel 1925d

Faye 1925h

Ensor 1925l

Finlay 1926d

Giacobini-Zinner 1926e

Comas-Sola 1926f

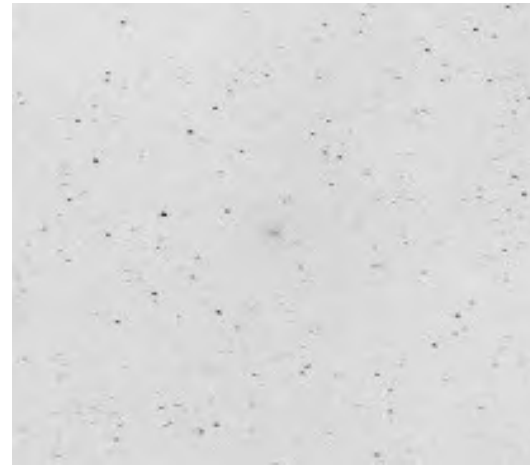
Pons-Winnecke 1927c

Schwassmann-Wachmann 1930d

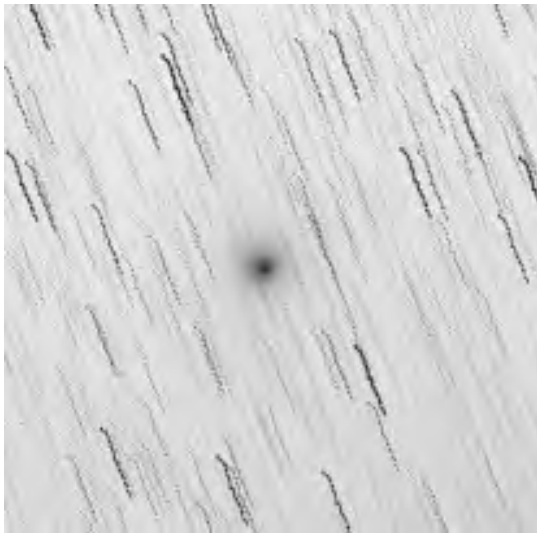
etc.



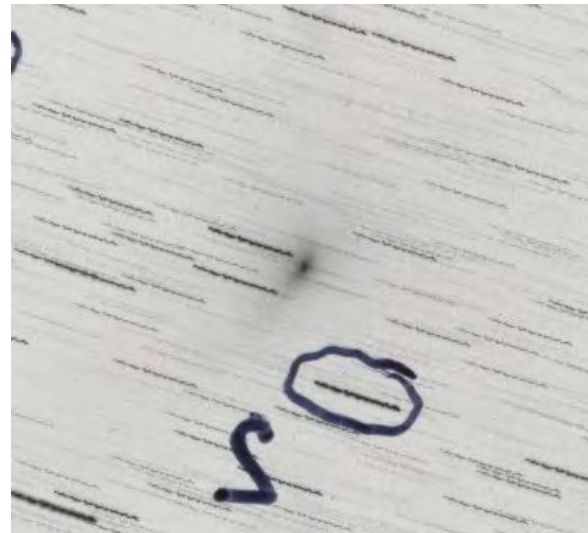
Gale 1912a



Kopff 1919a



Brorsen-Metcalf 1919b



Schwassmann-Wachmann 3 1930d

Cometary data in APPLAUSE

- **Potsdam: at least 4 in DR1, 8 more in DR2**

DR1 :

C/1910 A1 (Great January comet)

C/1911 N1 (Kiess)

C/1911 O1 (Brooks)

C/1932 P1 (Peltier-Whipple)

DR2 :

C/1956 R1 (Arend-Roland)

C/1955 O1 (Honda)

C/1955 N1 (Bakharev-Macfarlane-Krienke)

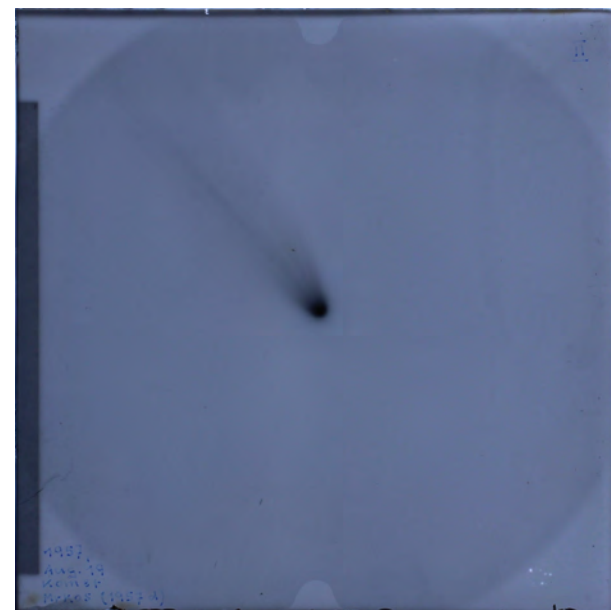
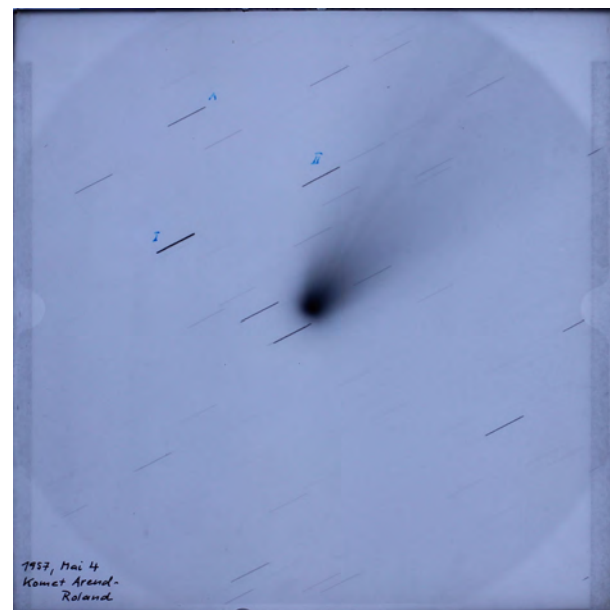
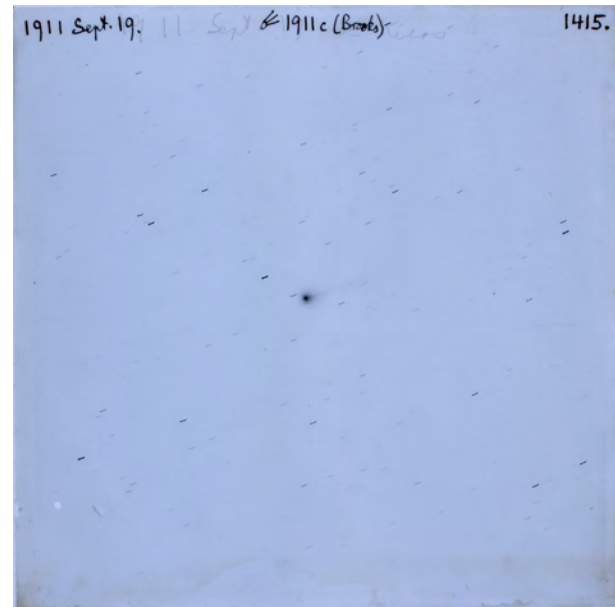
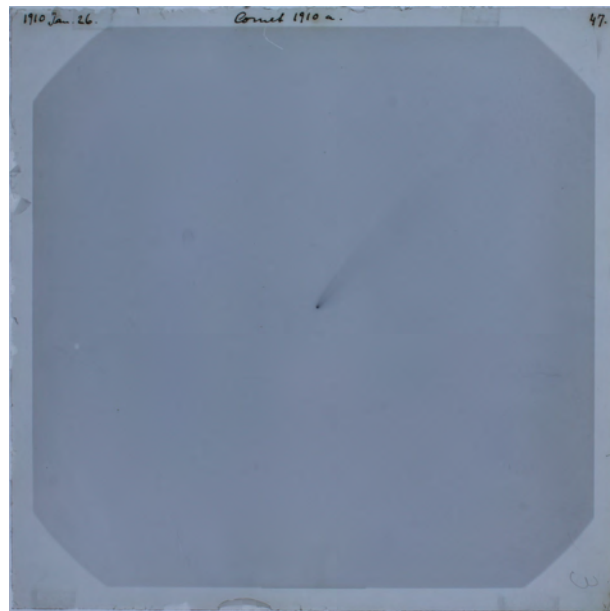
C/1957 P1 (Mrkos)

2P/Encke 1957c

C/1958 D1 (Burnham)

C/1959 Y1 (Burnham)

C/1960 Y1 (Candy)



Cometary data in APPLAUSE

- **Tartu: 32 comets expected**

Pons-Brooks 1953c

Abell 1953g

Baharev 1955f

Honda 1955g

Arend-Roland 1956h

Wilson-Hubbard 1961d

Humason 1961e

Seki-Lines 1962c

Alcock 1963b

Kearns-Kwee 1963d

Everhart 1964h

Alcock 1965h

Kilston 1966b

Tuttle 1967a

Wild 1967c

Honda 1968c

Bally-Clayton 1968d

Kohoutek 1969b

Kohoutek 1973f

Bradfield 1974b

Kobayashi-Berger-Milon 1975h

West 1975n

Kohler 1977m

Panther 1980u

Austin 1982g

Halley 1982i

etc.

Cometary data worldwide – how to?

- **Astroplate Meeting: www.astroplate.cz**

Organized by:

Astronomical Institute of the Academy of Science of the Czech Republic;

Institute of Chemical Technology in Prague;

Czech Technical University in Prague;

Dr. Remeis Observatory, University Erlangen-Nurnberg.

When / where:

first: March 18–21, 2014, Prague

next: March 2016, Prague



Cometary data worldwide – how to?

- **Astroplate Meeting: www.astroplate.cz**

Covered topics:

- all aspects of astronomical photographic plate and negative archives;
- scientific use and investigation;
- digitization hardware and techniques and data storage and handling;
- software and tools for data analyses;
- proper storage of photographic negatives and plates;
- restoration of plates and negatives;
- related chemical analyses and processes;
- historical and cultural aspects.

More details in: Astroplate 2014 Proceedings.

Cometary data worldwide – how to?

- **Astroplate mailing list: astroplate@to.ee**

mainly for announcements that are relevant to the people working with astronomical photographic material;

open for posting from addresses that are subscribed to the list;

emails sent from other addresses reach the list only after approval;

new subscriptions and changes of email addresses handled by the listowner (owner-astroplate@to.ee or taavi.tuvikene@to.ee).

Cometary data worldwide – how to?

- **Astroplate Wiki: www.plate-archive.org/wiki**

for sharing the knowledge about digitising and preserving astronomical photographic records;

open for reading to anybody in the world;

editing and discussing the content restricted to registered users;

for an account send an email with your preferred username to either Taavi Tuvikene (taavi.tuvikene@to.ee) or Harry Enke (henke@aip.de).



Application

I) Historical

- **Cometography:** e.g. discovery story, images, observations
- **History of cometary search:** e.g. unconfirmed Comet Barabashov (1925)

II) Astronomical

- **Astrometry:** much data still missing at & wanted by the MPC
- **Photometry:** light-curves, dust/gas, tail morphology, etc.
- **Past orbital passages:** e.g. C/2015 F5 SWAN-Xingming (P ~ 60 a)
- **Anything else?**



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Thank you!

www.aip.de