Leibniz-Institut für
Astrophysik Potsdam

Comets in digital plate archives on the example of APPLAUSE database

Sergei Schmalz (AIP), 07.06.2015
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(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)
  - Mayaki (150.000)
  - Sonneberg (300.000)
  - etc.
- Online-Archives:
  - DASCH (Harvard)
  - WFPDB (Sofia)
  - etc. etc. etc.

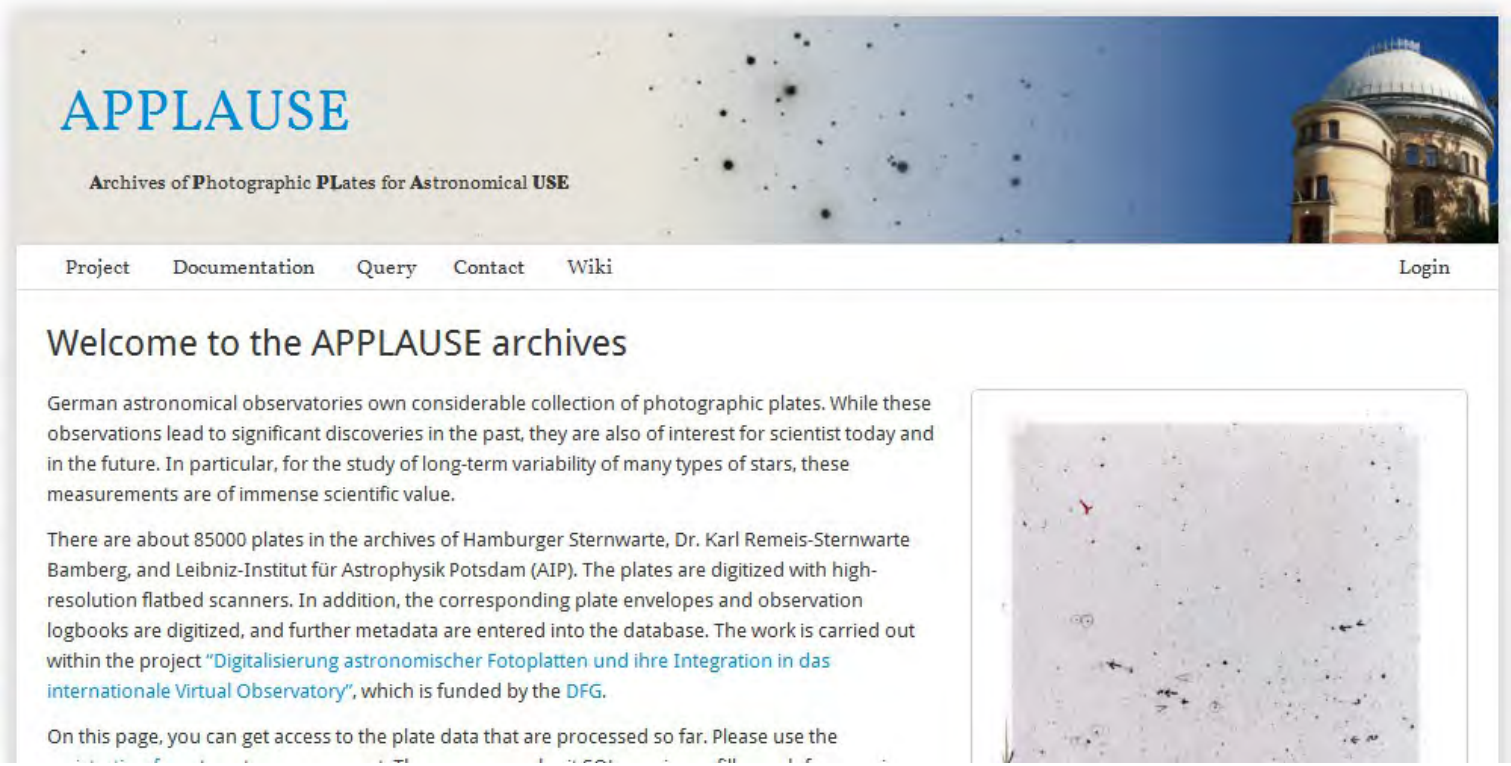
APPLAUSE: Database overview

- 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: Database overview

- General facts:

  APPLAUSE: **A**rchives of **P**hotographic **PL**ates for **A**stronomical **USE**;

  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);

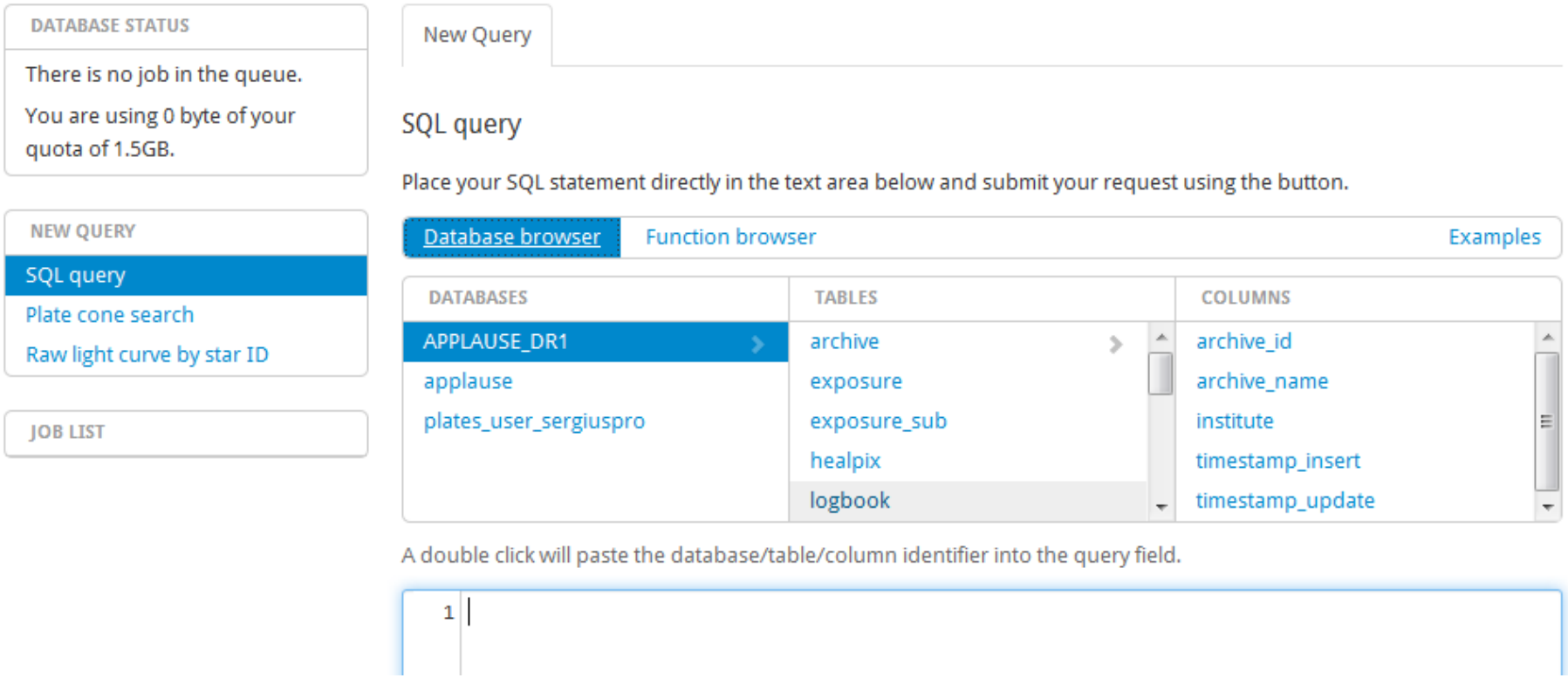
  astrometric reduction of multiple-exposure plates;

  exctraction and calibration of spectra;

  flagging of artefacts => candidates for Solar system objects.

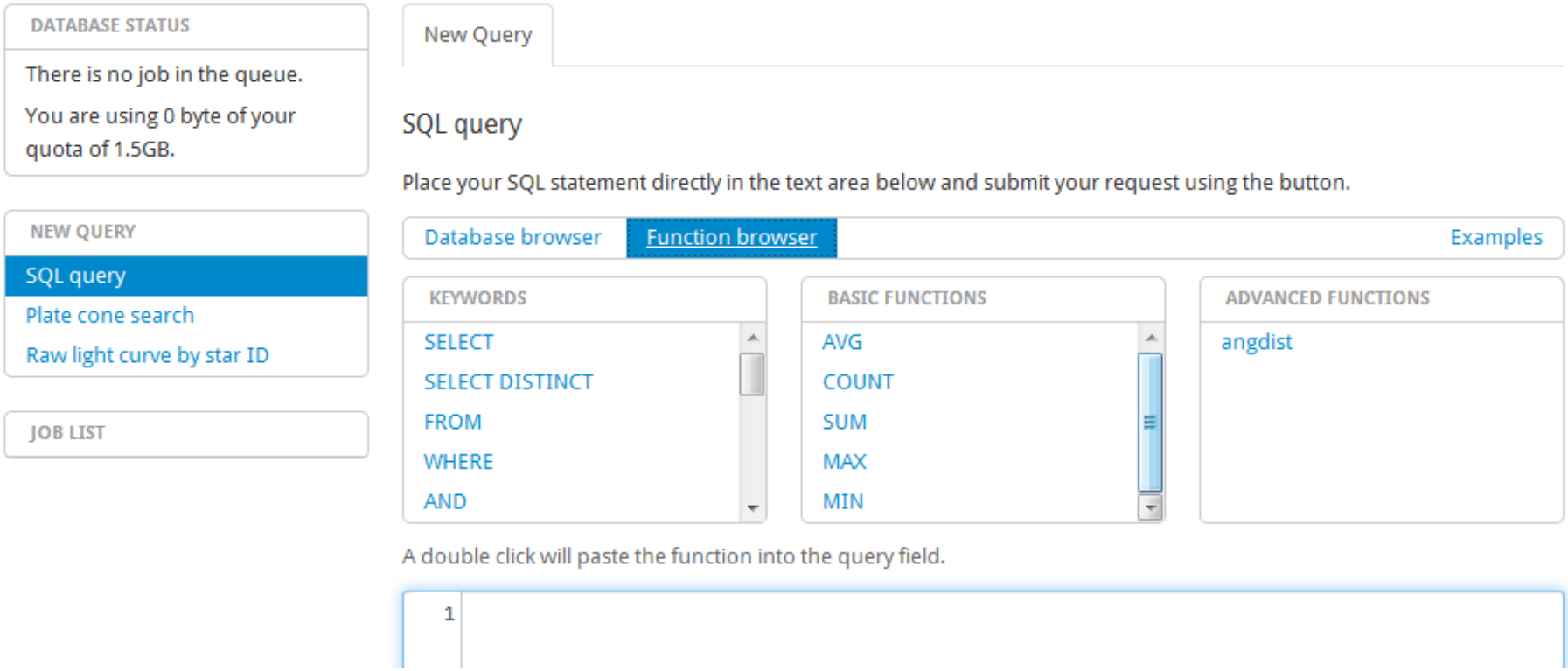
APPLAUSE: Database overview

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



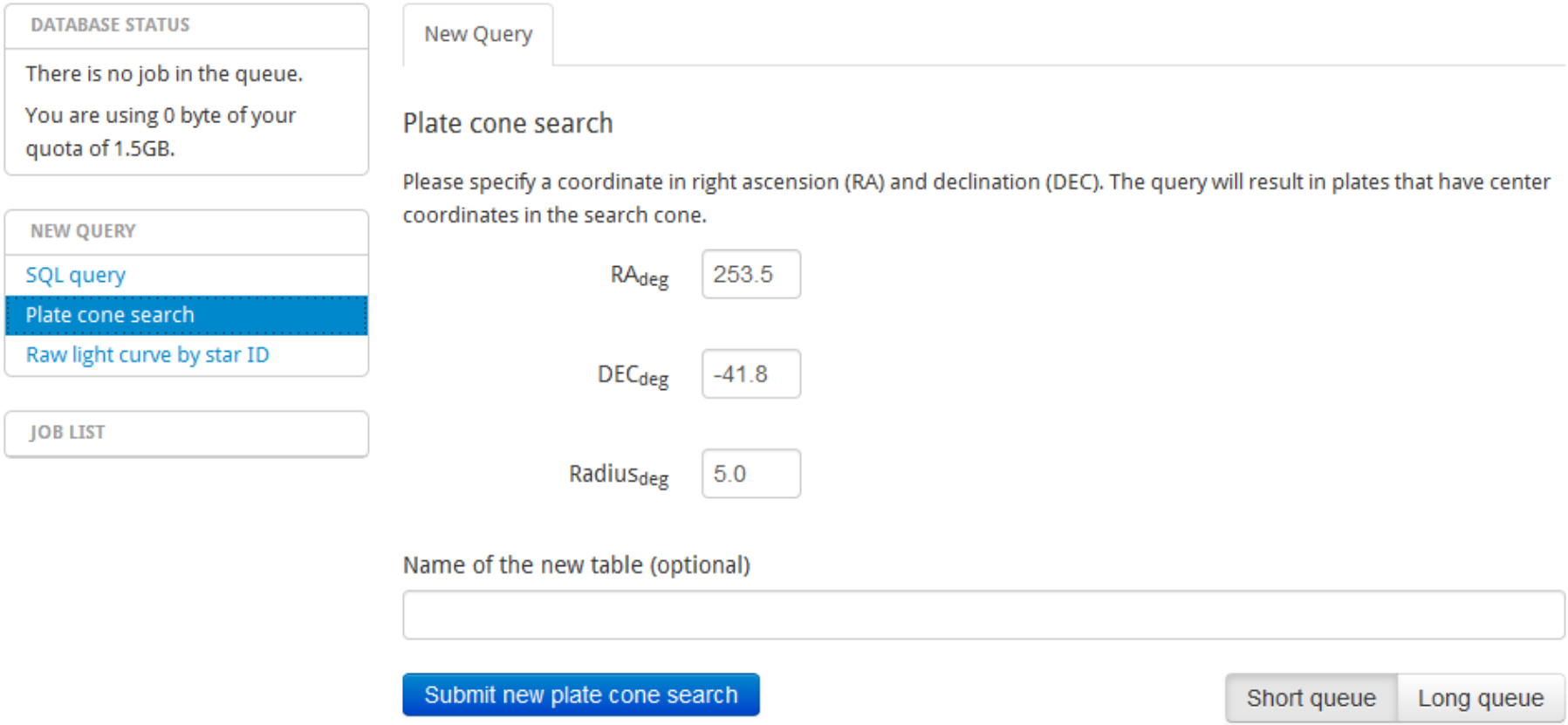
APPLAUSE: Database overview

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



APPLAUSE: Database overview

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



APPLAUSE: Acknowledgments

- Funded by DFG: Digitization of astronomical photographic plates and their integration in the international Virtual Observatory
- Bamberg: Ulrich Heber, Heinz Edelmann, 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

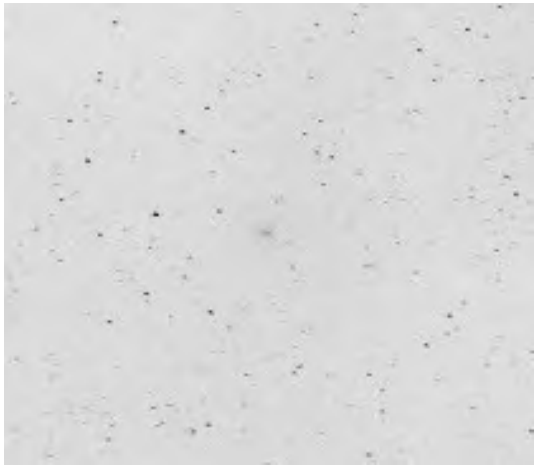
- Hamburg: **just a lot!**

Gale 1912a
Delavan 1912d
Kritzinger 1914a
Zlatinsky 1914b
Mellish 1915a
Taylor 1915e
Neujmin 1916a
Kopff 1919a
Brorsen-Metcalf 1919b
Metcalf 1919c
Schain 1925a
Tempel 1925d
Faye 1925h
Ensor 1925l

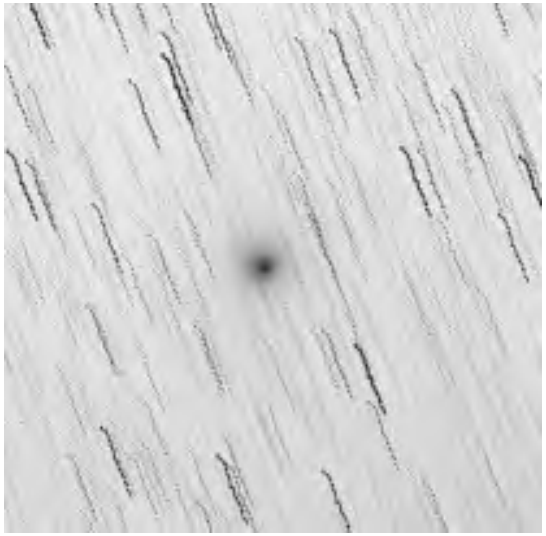
Finlay 1926d
Giacobini-Zinner 1926e
Comas-Sola 1926f
Pons-Winnecke 1927c
Schwassmann-Wachmann 1930d

etc.

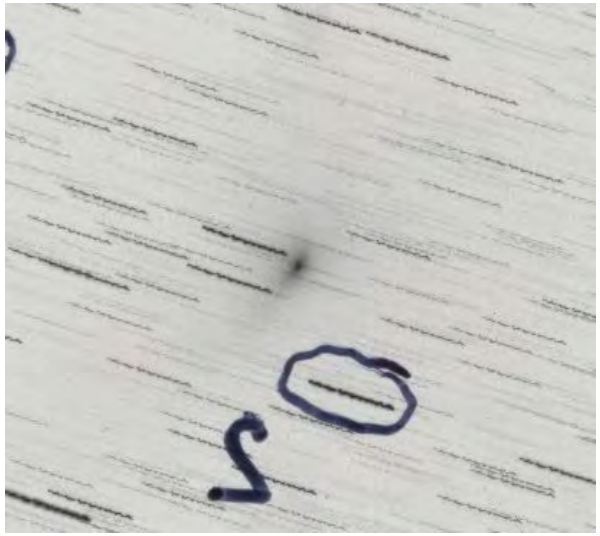
Gale 1912a



Kopff 1919a



Brorsen-Metcalff 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)

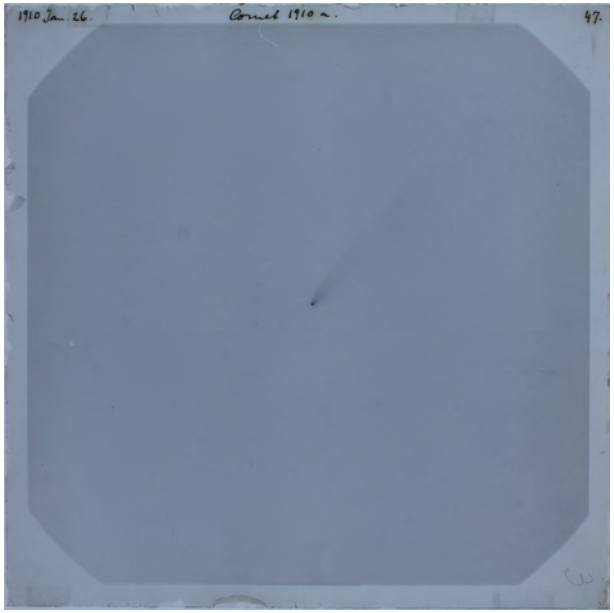
C/1957 P1 (Mrkos)

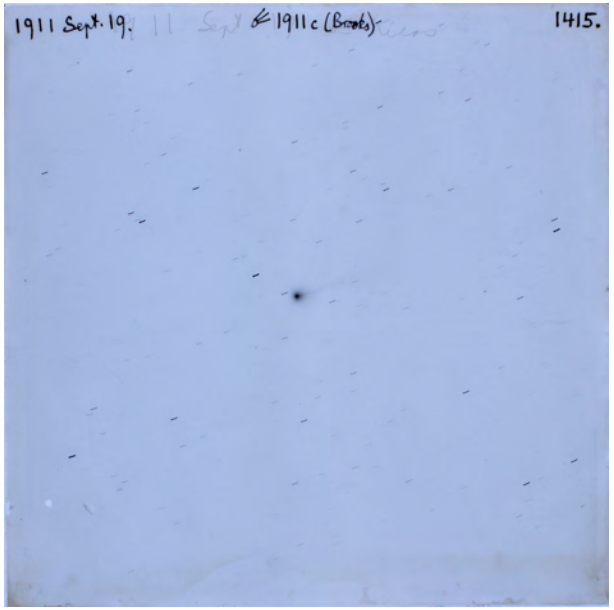
2P/Encke 1957c

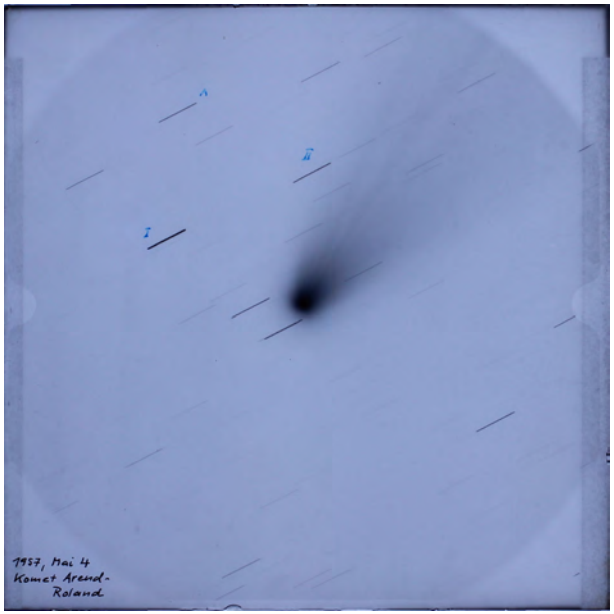
C/1958 D1 (Burnham)

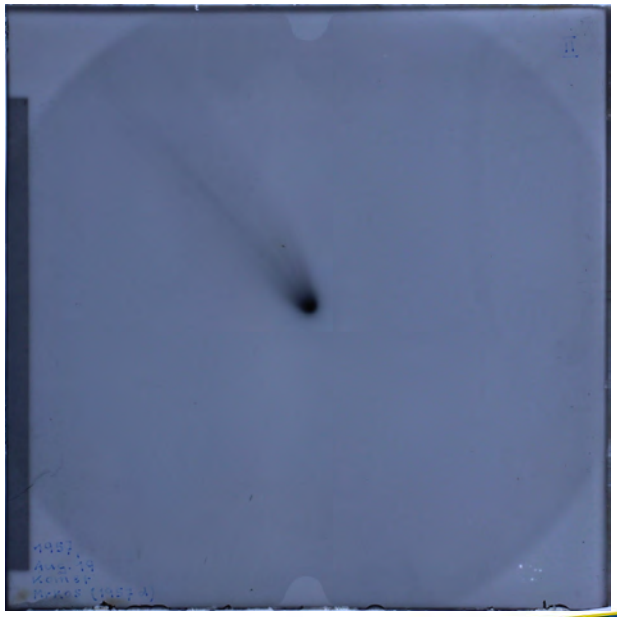
C/1959 Y1 (Burnham)

C/1960 Y1 (Candy)


1910 Jan. 26.
Comet 1910 a.
47.


1911 Sept. 19.
1911 c (Brooks)
1415.


I
II
1957, Mai 4
Komet Arend-
Roland



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!