

1st workshop

Astrophysical Winds and Disks, Similar Phenomena in Stars and Quasars



Wide-Field Plate Archives in Rozhen and Belgrade Observatories

Katya Tsvetkova, Milcho Tsvetkov, Milan Dimitrijevic, Vojislava Protic-Benishek and Vladimir Benishek

Institute of Astronomy, Bulgarian Academy of Sciences, Bulgaria

Astronomical Observatory, Belgrade, Serbia



Platamonas, Greece, September 3-8, 2009

Wide-Field Plate Archiving: Objective

Photography - as a method for astronomical observations since the first systematic observations of stellar clusters by B. Gould in 1872.

The used astronomical photographic plates as detectors and information storage were the basis of many astronomical discoveries.

Today:

The plates are the only information source for interesting astronomical objects requiring look and estimation of their positions and brightness back in time.

Papers based on the archival plates appear frequently helping to solve the questions about object origin, way of evolution, trajectories.

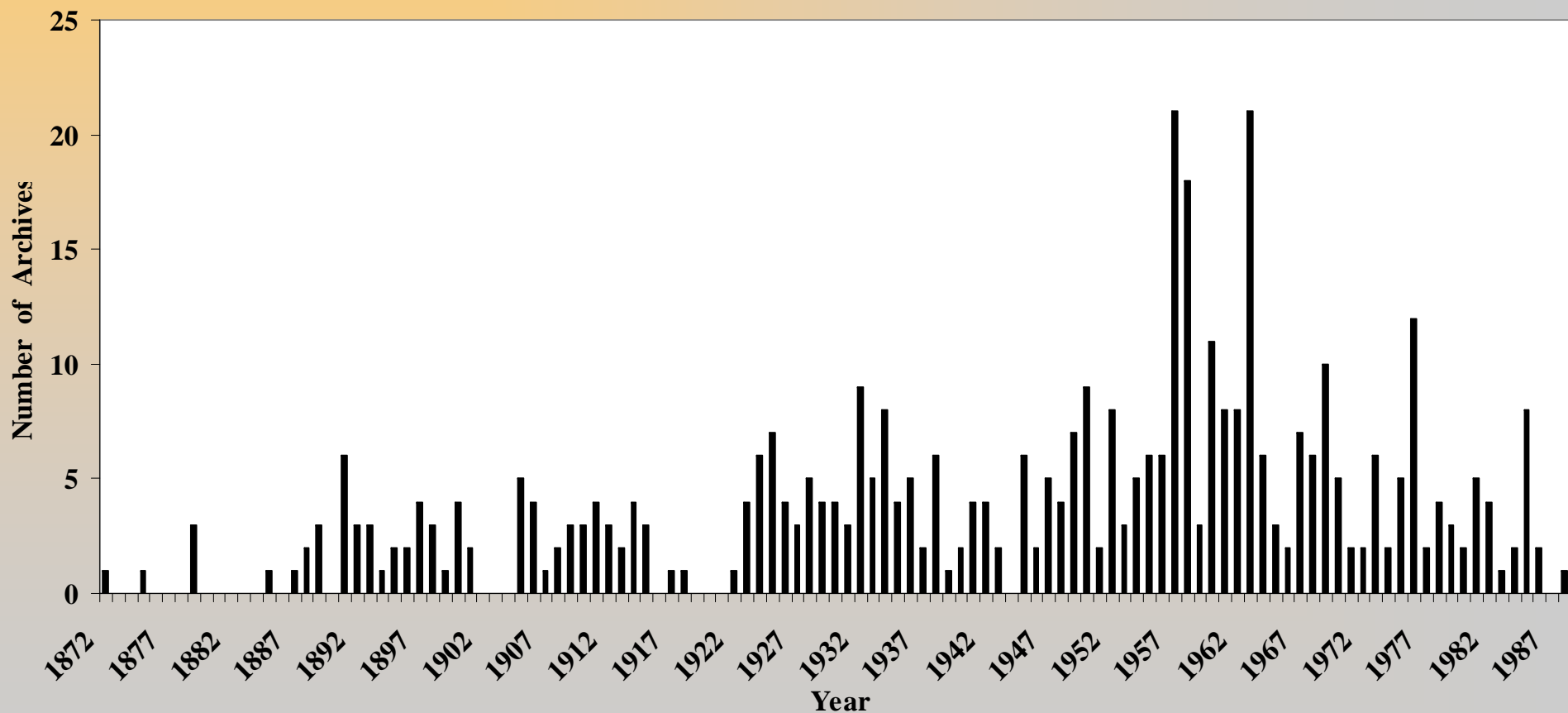
The plates used for more than 130 years can be considered not only as a present unique source of information for the past of the different astronomical objects, but also as scientific heritage representing the previous step of the present astronomical knowledge.

Wide-Field Plate Archiving: Definition of “Plate Archive”

As “plate archive” we denote a collection of plates produced with a definite telescope at a definite observational site and stored at a definite place. This means that one telescope may have more than one archive, if the telescope was moved or if its plates are stored at different observatories or institutions. The most of the wide-field plate archives are produced with small apertures telescopes up to 50-60 cm, mostly refractors, astrographs and cameras. The number of plates in the individual archives ranges between several tenths to more than 100000. Only a small number of archives have more than 10000 plates.

Wide-Field Plate Archiving: Worldwide Archives

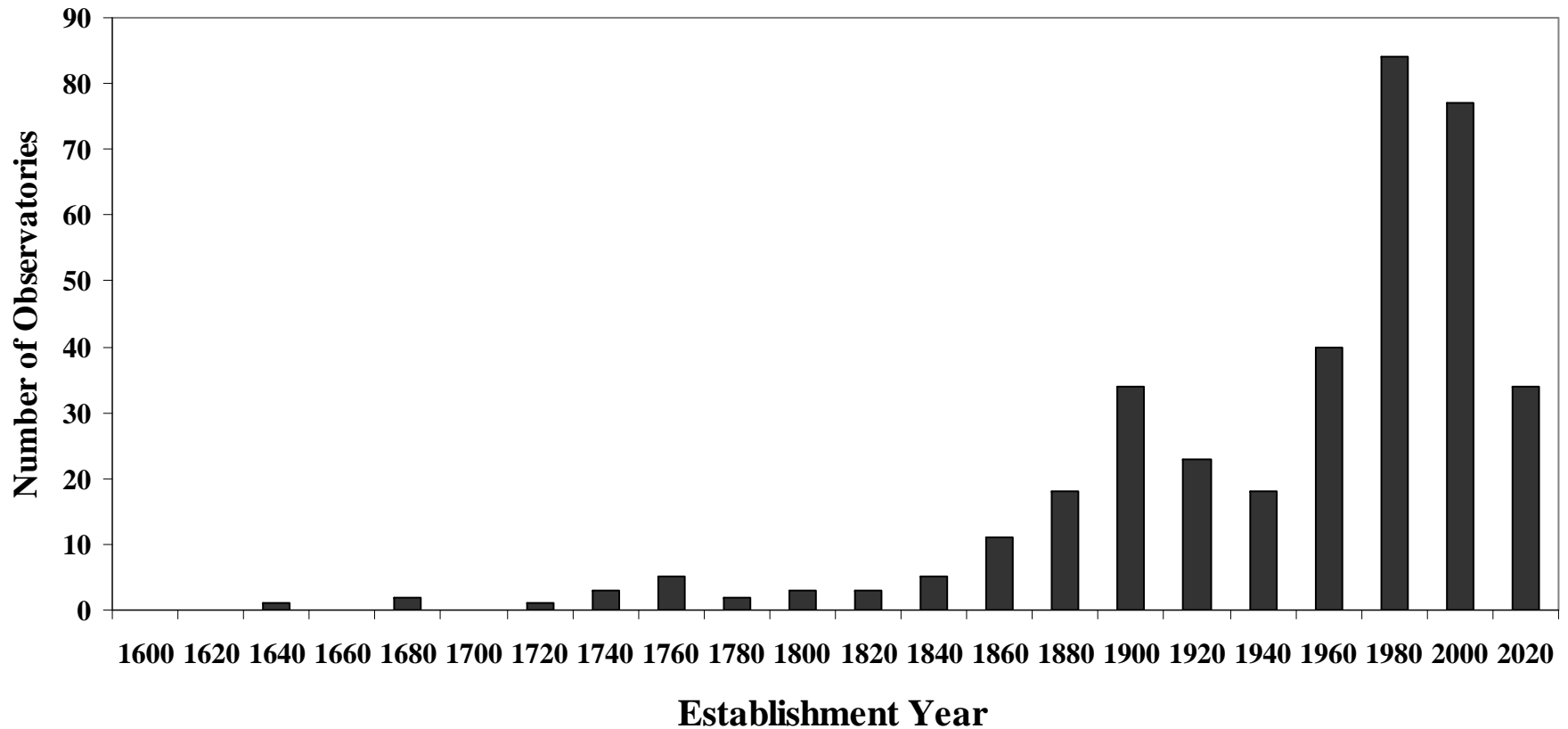
according to Catalogue of the Wide-Field Plate Archives (Tsvetkova and Tsvetkov, version August 2009)



Platamonas, Greece, September 3-8, 2009

Belgrade, Rozhen and Worldwide Observatories

for 364 astronomical observatories, operated and not more operated or only planned for near future: optical, ultraviolet, infrared, radio, solar space observatories (among about 580 operated observatories worldwide according to the *Astronomical Almanac 2009*)



Platamonas, Greece, September 3-8, 2009

Plate Library in Rozhen Observatory



Platamonas, Greece, September 3-8, 2009

Plate Library in Belgrade Observatory



Platamonas, Greece, September 3-8, 2009

Wide-Field Plate Archiving: Scanners

Requirements: The scanner must have high speed and provide astrometric and photometric accuracy while generating archival quality digital data.

Sofia Sky Archive Data Center:

PDS1010plus microdensitometer with possibility for high precision;

Flatbed Scanner: EPSON EXPRESSION 1640XL

Flatbed Scanner: EPSON PERFECTION V700 PHOTO

Rozhen Observatory:

Flatbed Scanner: EPSON EXPRESSION 10000XL

Belgrade Astronomical Observatory:

Flatbed Scanner: EPSON PERFECTION V700 PHOTO

Sofia Sky Archive Data Center: PDS 1010GM plus microdensitometer



Platamonas, Greece, September 3-8, 2009

Sofia Sky Archive Data Center: FB Scanner

**EPSON EXPRESSION
1640XL**

**Scanning platform:
310x437 mm;**

**Resolution: 1600x3200dpi,
Duration: 5min 16x16 cm
plate;**

**Plate Storage: FITS with
volume 120 MB.**



Platamonas, Greece, September 3-8, 2009

Rozhen Observatory: FB Scanner

**EPSON EXPRESSION
10000XL**

**Scanning platform: 310x437
mm**

Resolution: 1600x3200dpi

Duration: 5min 16x16 cm

Plate Storage: FITS

2m RCC plates 30x30 cm

Previews: Adobe Photoshop

600dpi, 24bit colour

TIFF; JPEG

Scans: Scanfits

1600dpi, 16bit grayscale

FITS (612MB)



Platamonas, Greece, September 3-8, 2009

Belgrade Astronomical Observatory: FB Scanner

EPSON PERFECTION V700 PHOTO

Scanning platform: 216x297mm;

Resolution: up to 6400 dpi,

Duration of scan for 9x5 cm plate: 6 min

(2 min for prescan and 4 min for real scan),

Plate Storage: volume about 30 MB for 9x5 cm plate.



Platamonas, Greece, September 3-8, 2009

Wide-Field Plate Archives: Telescopes: Rozhen

Main Characteristics

WFPDB Instr. Identifier	Tel.Orig. Name	Aperture (m)	Focal Length (m)	Scale "/mm	Tel. Type	Field Size (deg)	Years of Operation
ROZ050	Schmidt	0.50/0.70	1.72	120	Sch	4.5	1979-1994
ROZ200	RCC	2.00	16	13	RCr	1.0	1979-1993

Wide-Field Plate Archives: Telescopes: Rozhen

From the Catalogue of Wide-Field Plate Archives (August 2009)

WFPDB Instr. Identifier	Years of Operation	Plate Number	Archive Type	Astronomer in Duty
ROZ050	1979-1994	7359 (214)	C	M. Tsvetkov
ROZ200	1979-1993	2007	C	N. Petrov

Wide-Field Plate Archives: Telescopes: Belgrade

Main Characteristics

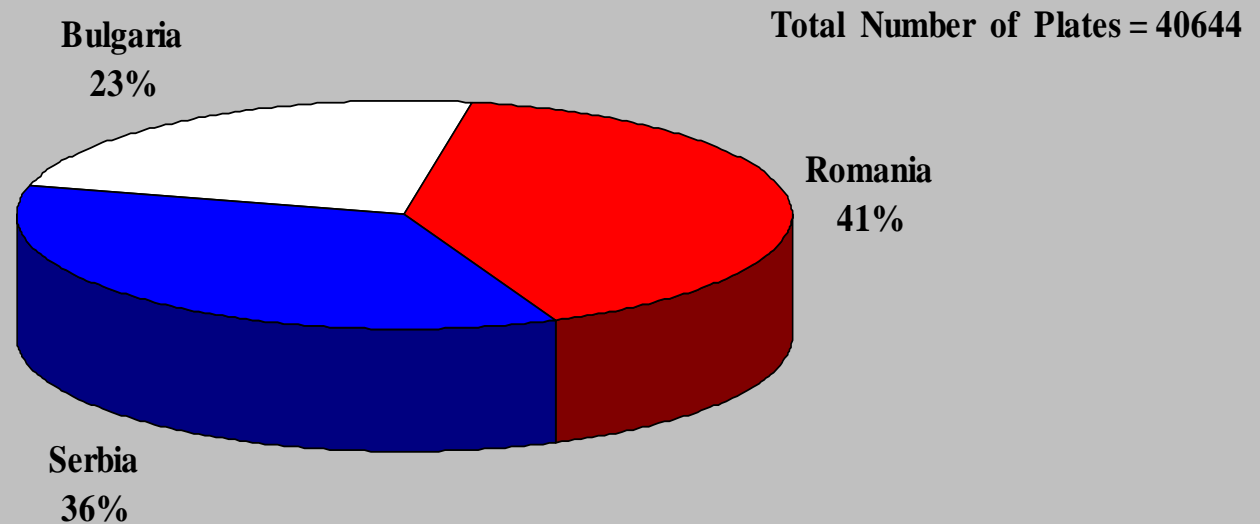
WFPDB Instr. Identifier	Tel.Orig. Name	Aperture (m)	Focal Length (m)	Scale "/mm	Tel. Type	Field Size (deg)	Years of Operation
BEL012	Askania Rfr	0.12	1.00	206	Rfr	7.0	1970-1996
BEL016A	Zeiss Rfr	0.16	0.80	258	Cam	11.5	1936-1985
BEL016B	Zeiss Ast	0.16	0.80	258	Cam	11.5	1936-1941

Wide-Field Plate Archives: Telescopes: Belgrade

From the Catalogue of Wide-Field Plate Archives (August 2009)

WFPDB Instr. Identifier	Years of Operation	Plate Number	Archive Type	Astronomer in Duty
BEL012	1970-1996	4000	TC	V. Protic-Benishek
BEL016A	1936-1985	10000	TC	V. Protic-Benishek
BEL016B	1936-1941	500	T	V. Protic-Benishek

Wide-Field Plate Archiving: Balkan Archives



Rozhen Wide-Field Plate Telescopes



Platamonas, Greece, September 3-8, 2009

Rozhen Wide-Field Plate Telescopes



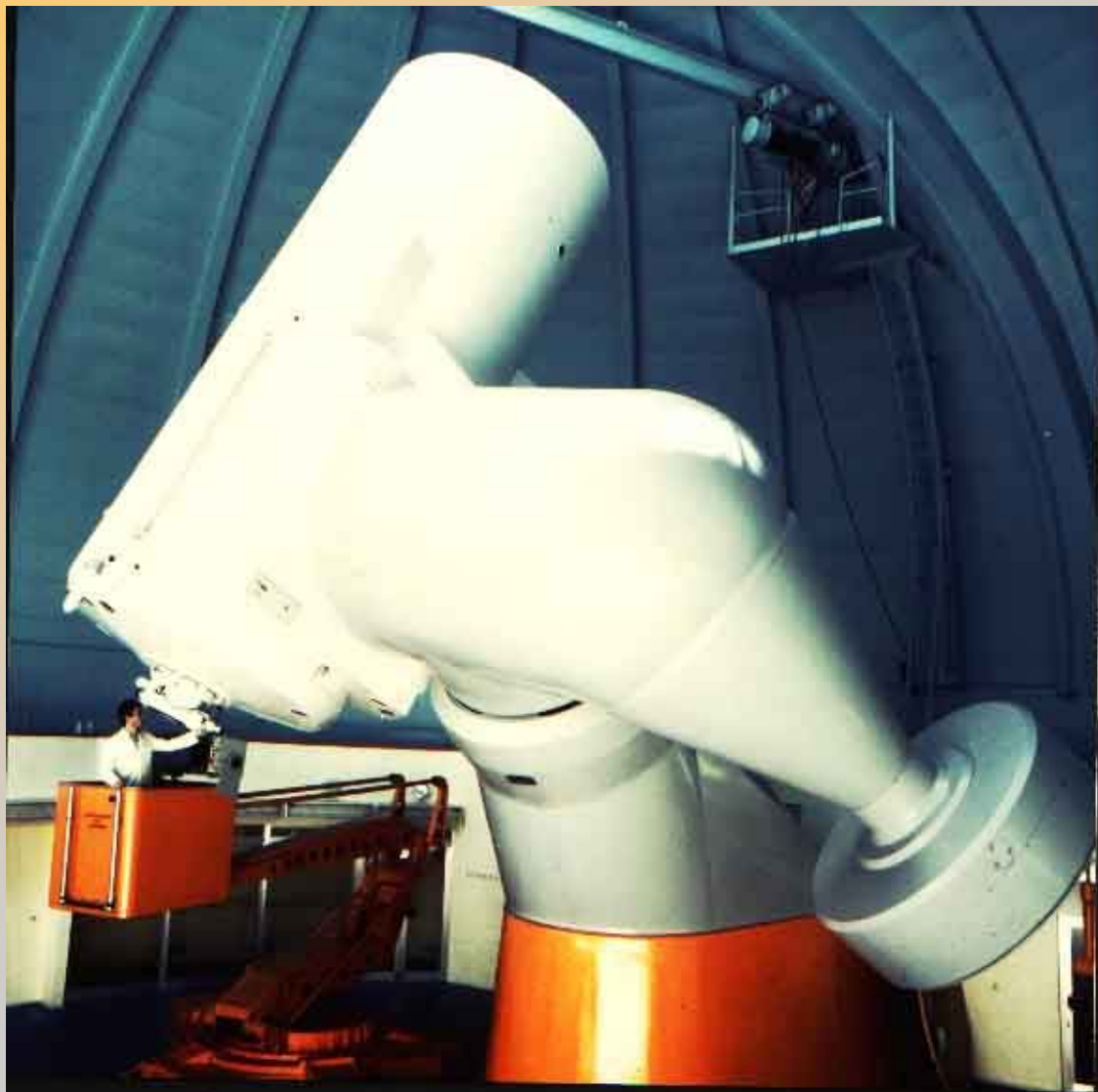
Platamonas, Greece, September 3-8, 2009

Rozhen Wide-Field Plate Telescopes



Platamonas, Greece, September 3-8, 2009

Rozhen Wide-Field Plate Telescopes: 2mRCC



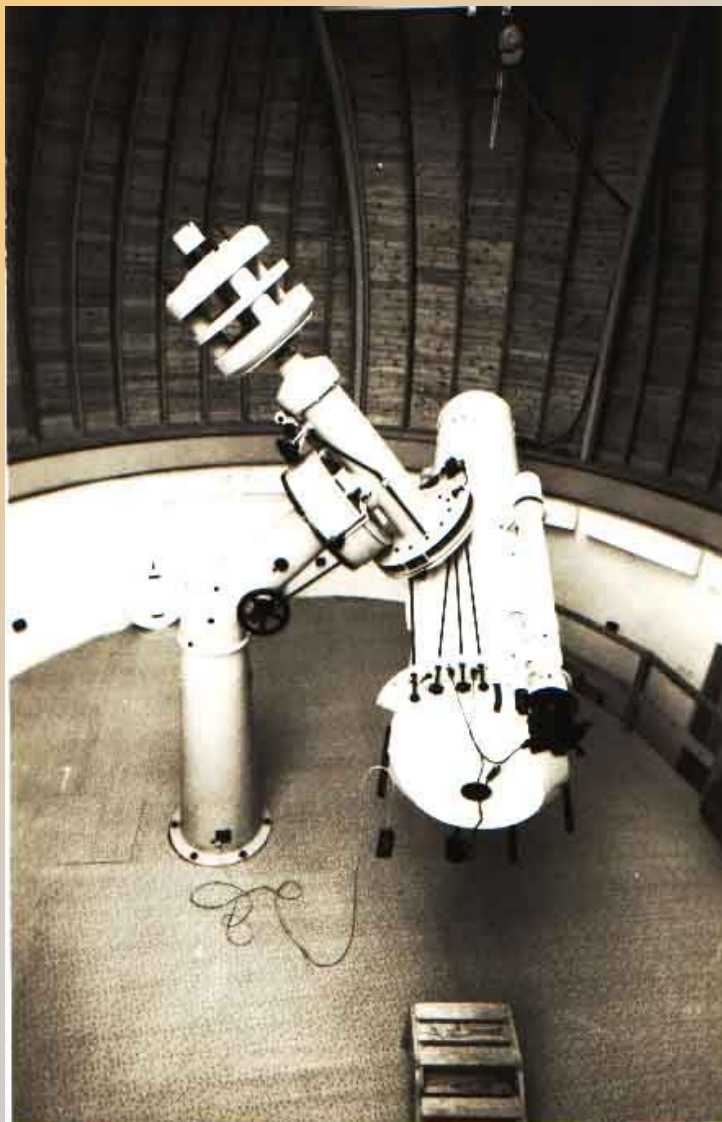
Platamonas, Greece, September 3-8, 2009

Rozhen Wide-Field Plate Telescopes



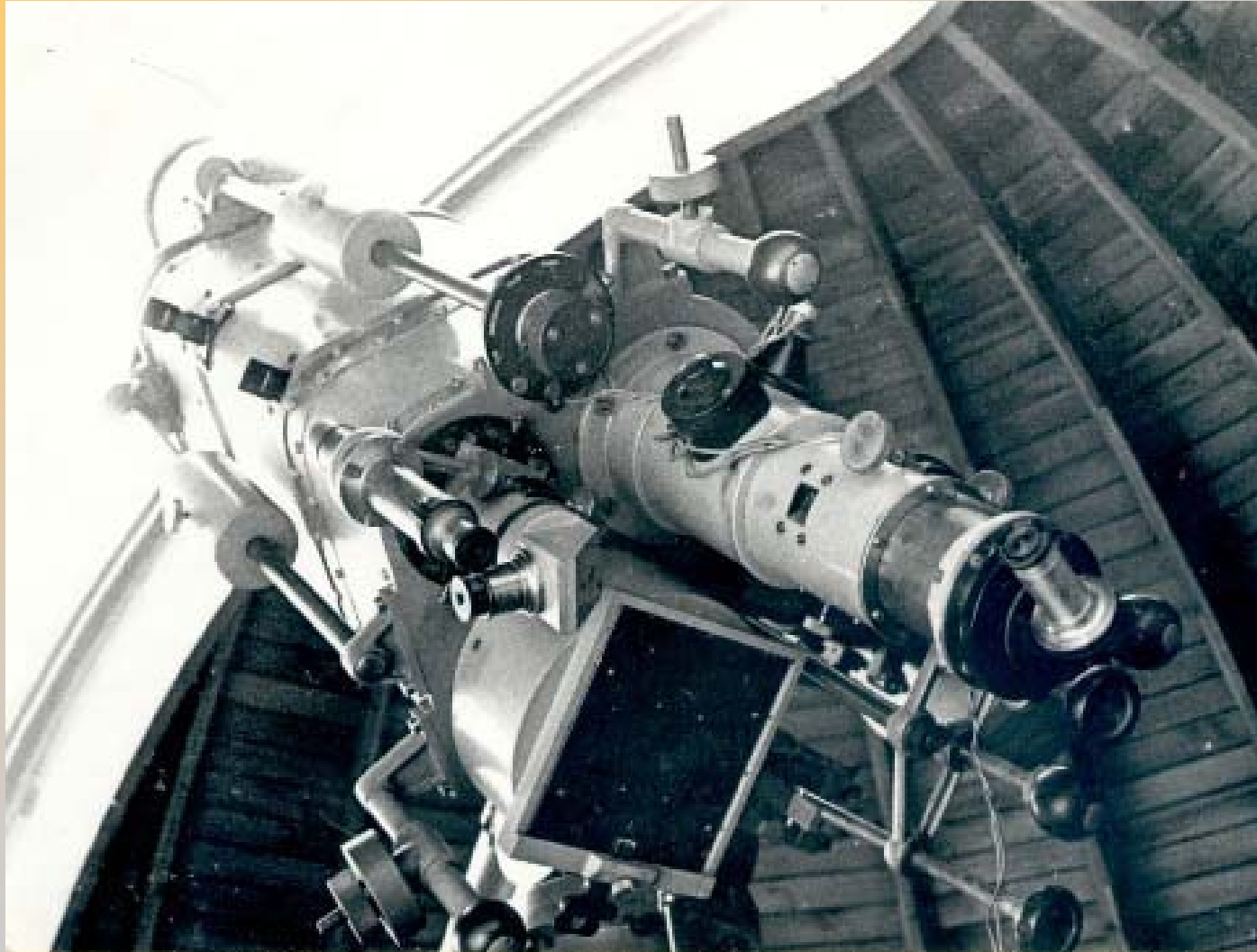
Platamonas, Greece, September 3-8, 2009

Rozhen Wide-Field Plate Telescopes: 50/70/172 cm Schmidt



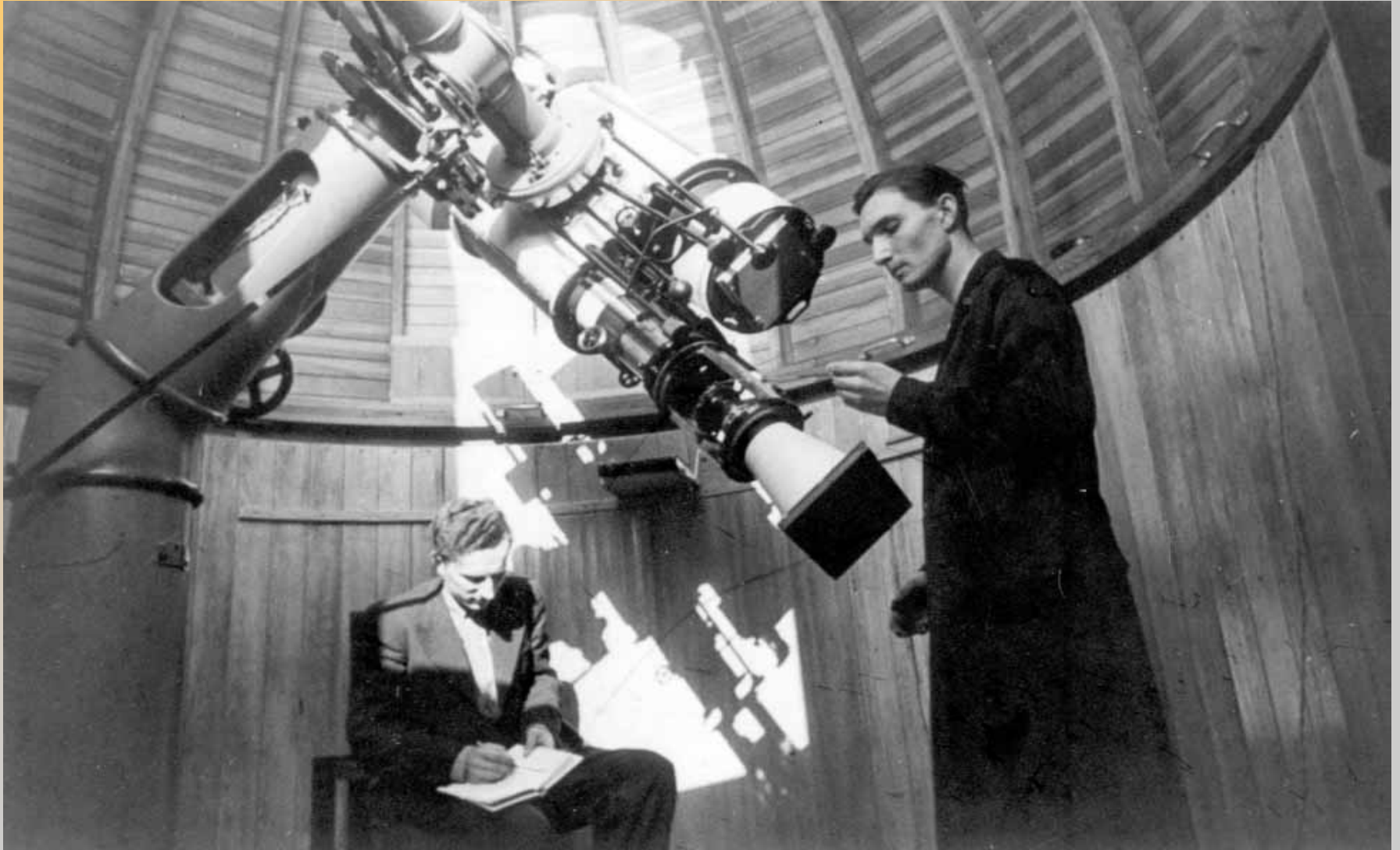
Platamonas, Greece, September 3-8, 2009

Belgrade Wide-Field Plate Telescopes: Askania Refractor



Platamonas, Greece, September 3-8, 2009

Belgrade Wide-Field Plate Telescopes: Zeiss Astrograph



Platamonas, Greece, September 3-8, 2009

Belgrade Wide-Field Plate Archives: Logbooks



Platamonas, Greece, September 3-8, 2009

Belgrade Wide-Field Plate Archives: Observers

OBSERVERS FROM THE BELGRADE OBSERVATORY:

*Vojislav V. Mišković
Milorad Protić
Pero Đurković
Zaharije Brkić
Branislav Ševarlić
Časlav Čepinac
Dragomir Olević
Vojislava Protić-Benišek
Zoran Knežević
Vladimir Benišek*

OCCASIONALLY:

*Vasilije Oskanjan
Aleksandar Kubičela
Jelisaveta Arsenijević
Ištvan Vince
Dačić Ljubiša
Grujić Radomir*

Wide-Field Plate Archives: Characteristics:Belgrade

Used emulsions and plate size

Kodak 103aO, IIaO, 103aJ, 103aF,
etc.

Ferrania Panchro anti-halo

Agfa Astro

Peruts

Gevaert Super Chromosa

ORWO ZU2, ZU21

Ilford

Size of used plates (cm)

6x9, 9x12, 13x18, 15x15, 16x16



Wide-Field Plate Archives: Observing Programmes

The main characteristic of the observing programmes carried out with wide-field ($> 1^\circ$) plates is their long duration.

The result: accumulation of large knowledge about the observed phenomena.

A compiled list of astronomical tasks and results achievable through the access to digitized archival plates from at least two plate archives stored in different astronomical observatories or institutions:

- Composed light curves of variable stars for as long as it is possible time period;
- Search for long-term brightness variations - in young solar-type stars, RS CVn, active red dwarf stars, the Pleiades red dwarf stars;
- Search for past eruptions of pre-main sequence stars;
- Observations of small solar system bodies;
- Search for optical analogues of Gamma Ray Bursts;
- Search for photometric variability of quasars;
- Supernovae search in digitized archives;
- Usage of Carte du Ciel plates - for proper motion determinations, for discoveries of quick brightness changes, for investigations of the differential rotation in the galactic plane up to 500 pc from the Sun.

Wide-Field Plate Archives: Observing Programmes: Rozhen

2m RCC telescope

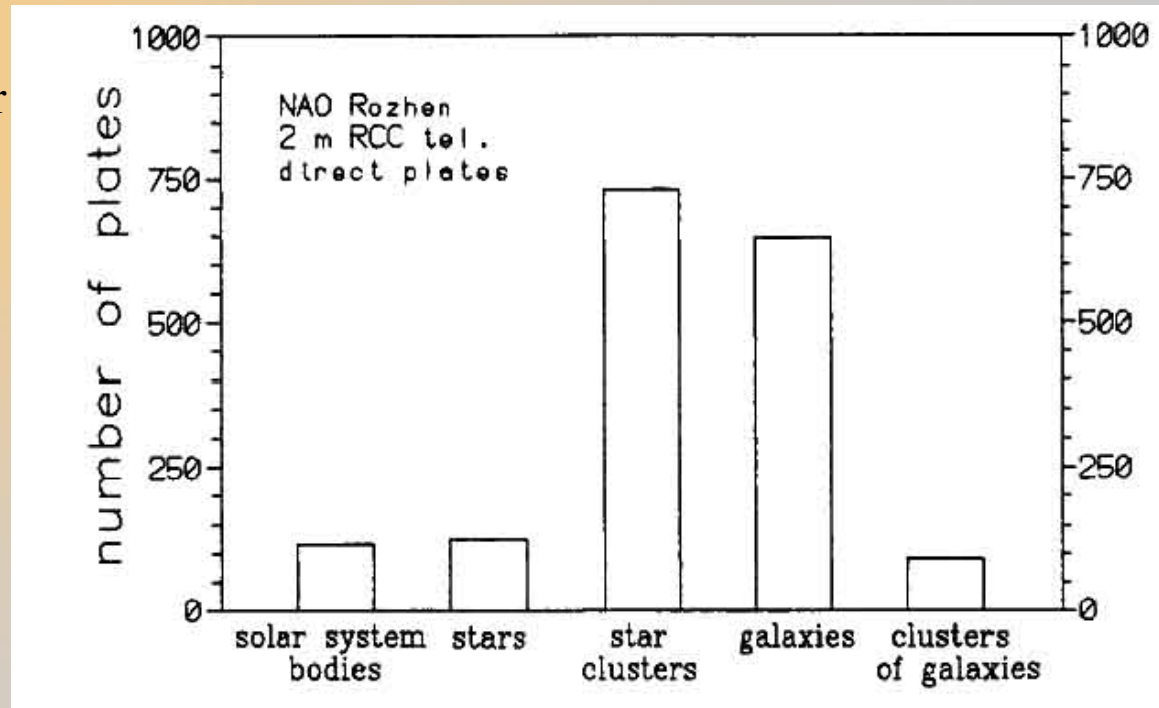
Photometric investigations of stellar clusters

Investigations of galaxies

Investigations of stars

Minor planets

Used emulsions: ORWO, Kodak



Wide-Field Plate Archives: Observing Programmes: Rozhen

50/70/172 cm Schmidt telescope

According to Effective Observing Time:

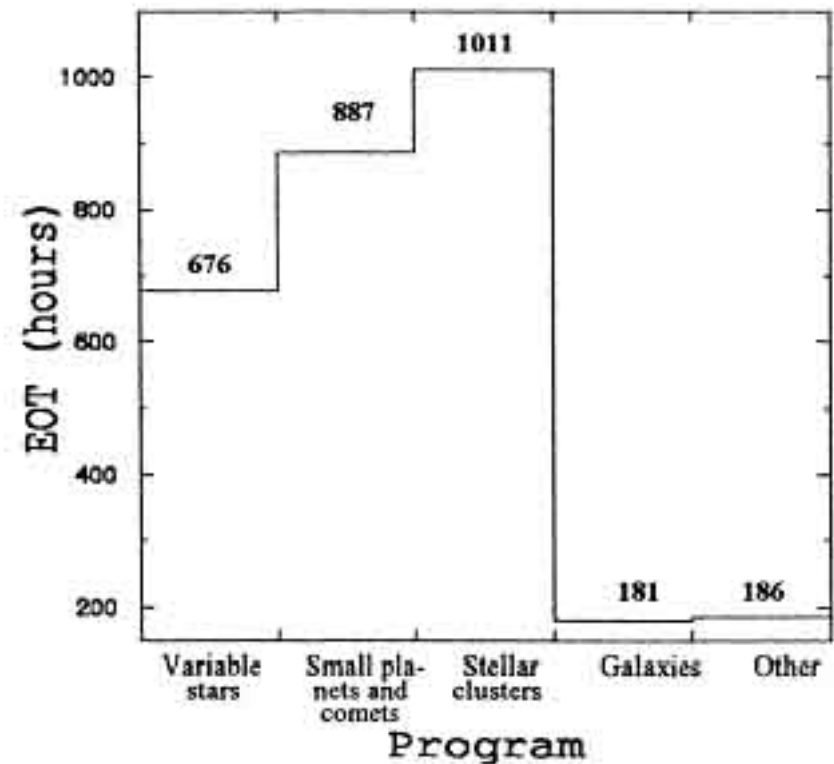
Photometric investigations of stellar clusters

Minor planets

Patrol observations of flare stars in stellar aggregates

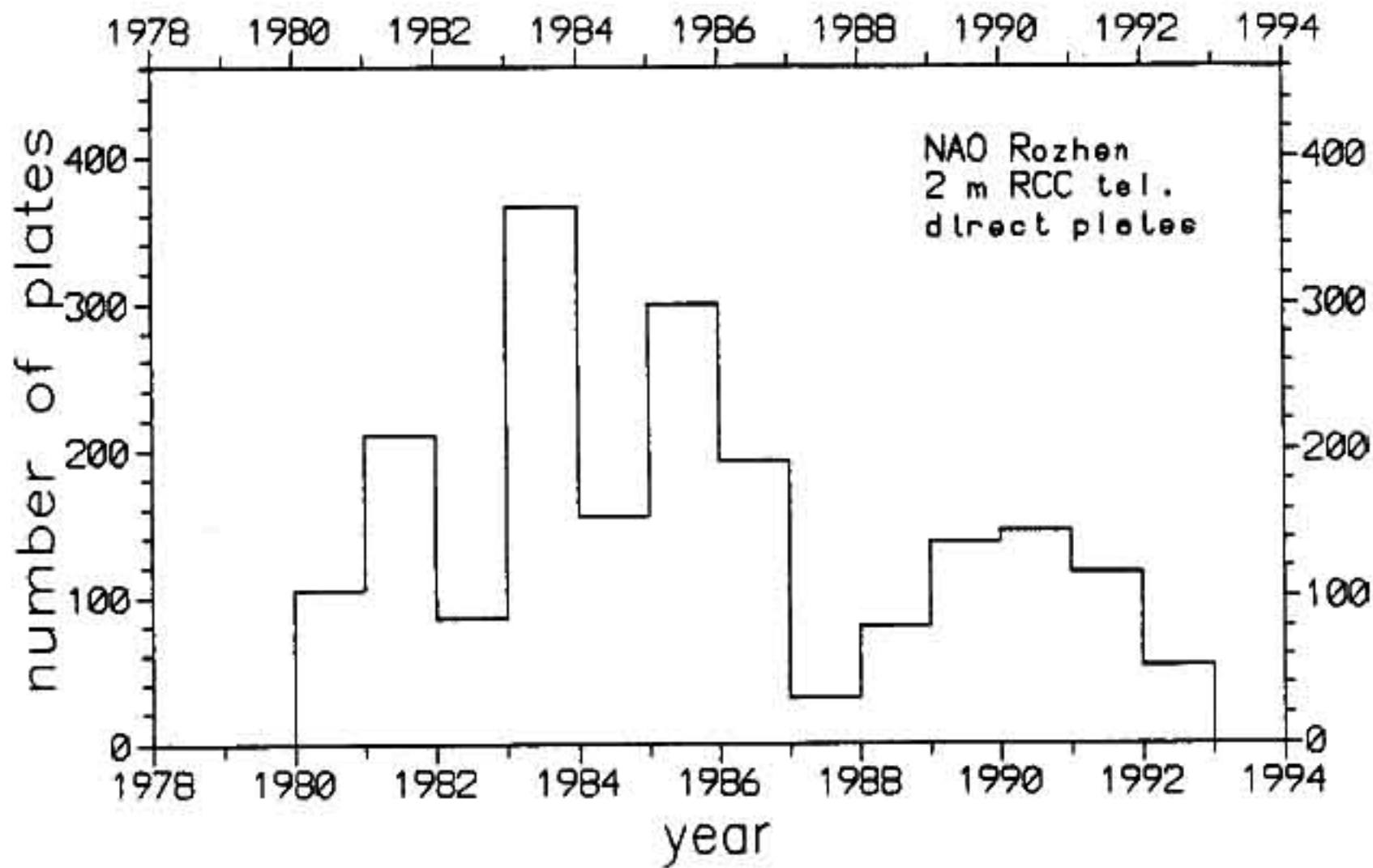
Investigations of galaxies

Used emulsions: ORWO, Kodak



Wide-Field Plate Archives: Characteristics: ROZ200

Time distributions of the plates



Wide-Field Plate Archives: Characteristics: ROZ200



Wide-Field Plate Database - Sofia



[WFPDB](#)

[WFPDB@VizieR](#)

[Aladin](#)

[Other Plate Catalogues](#)

[Access Log](#)

[Help](#)

Details for archive: ROZ200

Location of the Archive:

Site: **Rozhen**

Country: **Bulgaria**

Observatory:

Name: **Rozhen NAO**

Site: **Rozhen**

Country: **Bulgaria**

Time zone: +2 h

East longitude: 24° 45.0'

Latitude: 41° 43.0'

Altitude: 1760 m

Clear aperture:

Mirror diameter: 2.00 m

Focal length: 16.00 m

Scale: 13 "/mm

Type: RCr

Field size: 1.0°

Years of operation:

From: 1979

To:

P/F:

Number of direct plates: 1995

Archive type: C

Number of spectral plates:

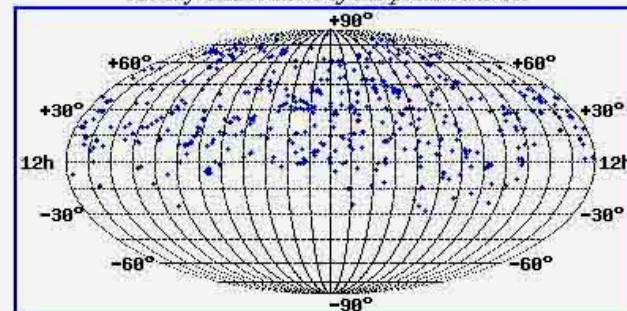
Archive type:

Number of plates in WFPDB: 1984

Quality: D

Astronomer in charge: [K.Stavrev](#)

All-sky distribution of the plate centres:



Wide-Field Plate Archives: Characteristics: ROZ050



Wide-Field Plate Database - Sofia



[WFPDB](#)

WFPDB@VizieR

[Aladin](#)

[Other Plate Catalogues](#)

[Access Log](#)

[Help](#)

Details for archive: ROZ050

Location of the Archive:

Site: **Sofia**

Country: **Bulgaria**

Observatory:

Name: **Rozhen NAO**

Site: **Rozhen**

Country: **Bulgaria**

Time zone: +2 h

East longitude: 24° 45.0'

Latitude: 41° 43.0'

Altitude: 1760 m

Clear aperture: 0.50 m

Mirror diameter: 0.70 m

Focal length: 1.72 m

Scale: 120 "/mm

Type: Sch

Field size: 4.5°

Years of operation:

From: 1979

To:

PIF:

Number of direct plates: 7335

Archive type: C

Number of spectral plates: 214

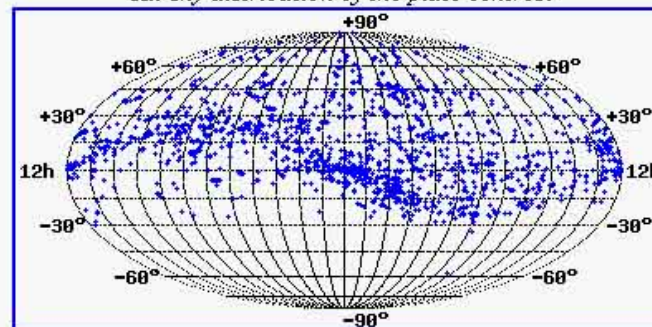
Archive type: C

Number of plates in WFPDB: 7359

Quality: D

Astronomer in charge: [M.Tsvetkov](#)

All-sky distribution of the plate centres:



Wide-Field Plate Archives: Observing Programmes: Belgrade

Minor planets tracking

Search for new minor planets (33 new)

Observations of comets

Observations of the Moon

Major planets and their satellites

Passage of Mercury

Lunar occultations

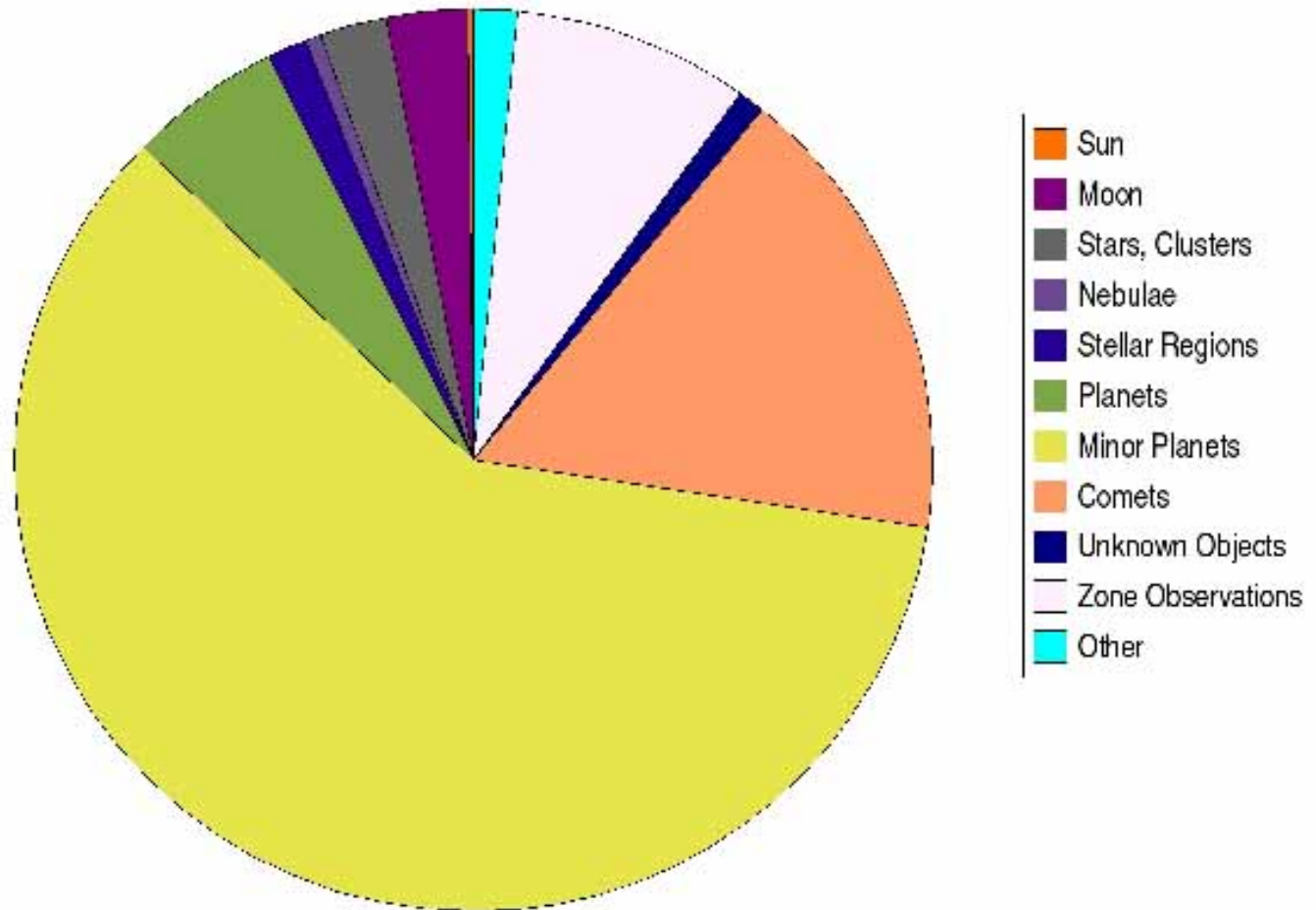
Variable stars

Double stars

Stellar clusters

Wide-Field Plate Archives: Observing Programmes: Belgrade

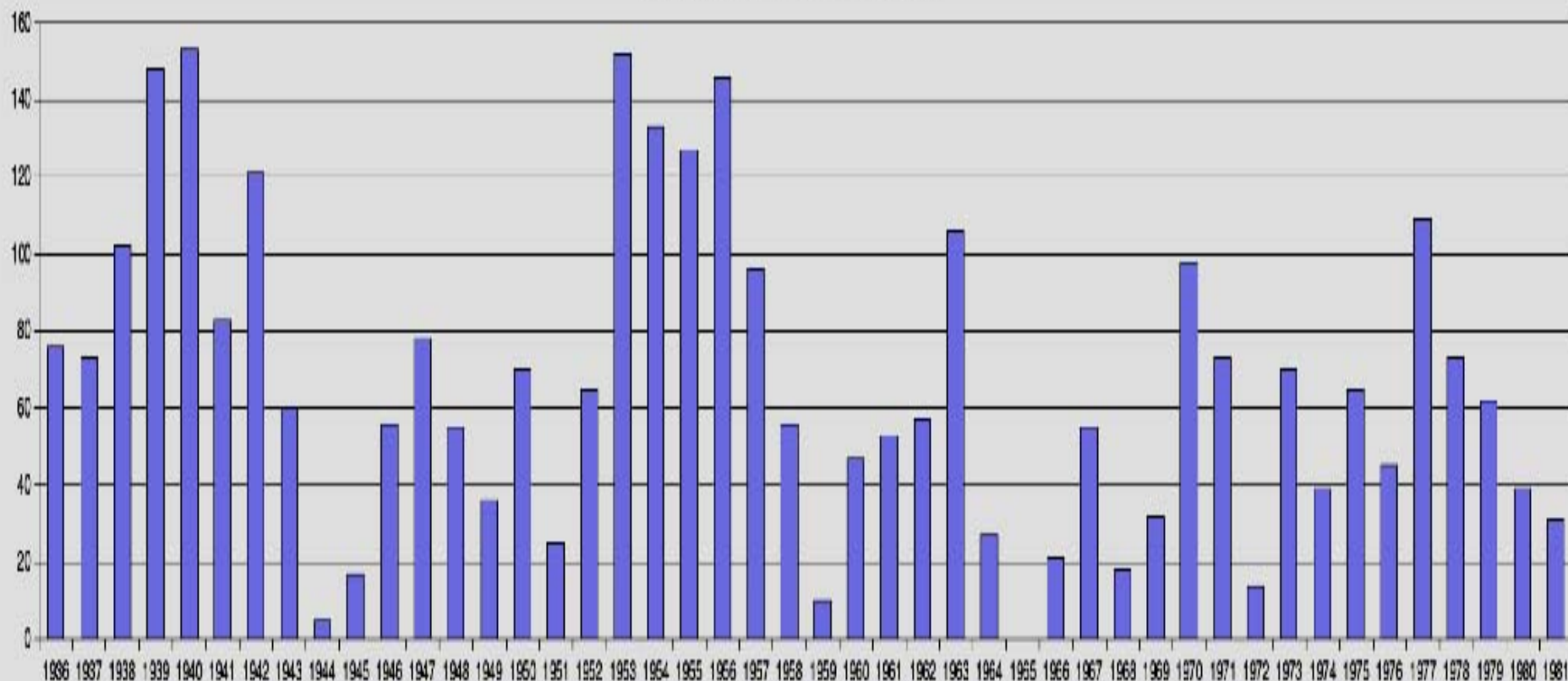
Types of objects observed



Platamonas, Greece, September 3-8, 2009

Wide-Field Plate Archives: Characteristics: Belgrade

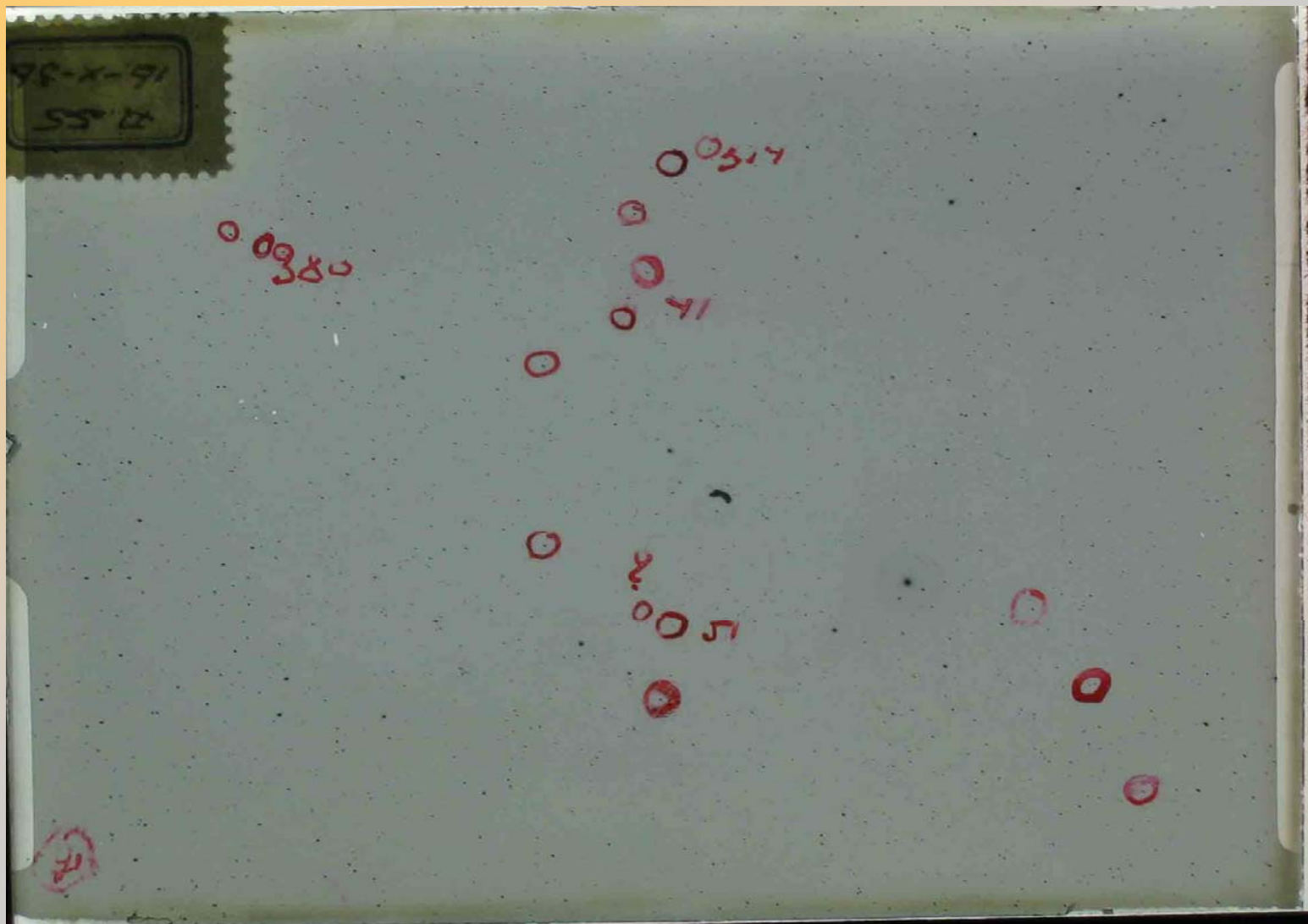
Time Distribution of the scanned 3000 plates



Platamonas, Greece, September 3-8, 2009

Wide-Field Plate Archiving: Scanning

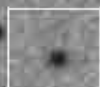
Plate preview as snapshot made with digital cameras: Minor Planet Serbia



Platamonas, Greece, September 3-8, 2009

Wide-Field Plate Archiving: Scanning

ols - Window



Lister - [F:\Beograd_scans_2007\U700\111.fits]

File Edit Options Help

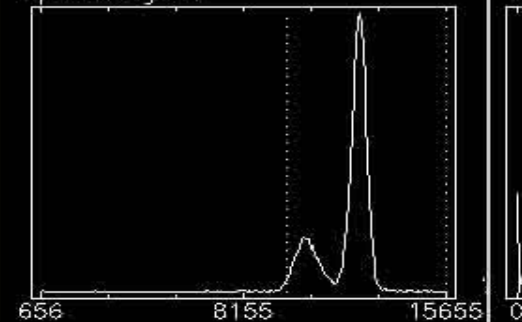
```
SIMPLE = T / Plain FITS format ver. 0.7
BITPIX = 16 /
NAXIS = 2 /
NAXIS1 = 11270 /
NAXIS2 = 5739 /
BZERO = 0 /
INVERTED= T /
SCANBITS= 14 /
OBJECT = 'test' /
OBSERVER= 'Protich' /Name of observer
OBSERVAT= 'Belgrade' /Where the plate was
INSTRUME= 'Plate' /
TELESCOP= 'Astr(Zeiss 16.0)' /
PLATENUM= '1111' /Catalog ident. of p
EMULSION= 'Afga Super Chrom' /Type of emulsion
PQUALITY= 'Good' /Preservation of pla
FILTER = 'Pg' /
PRISMANG= '0' /Prism angle (dd.mm.
TELSCALE= 325.00 /Telescope scale (arc
EXPTIME = 60.00 /Exposure time (minu
DISPERS = 0.00 /Dispersion (A/mm)
MULTIEXP= '1' /UT and min. of mult
SCANNER = 'EPSON Perfection U700/U750' /Model of scanner us
DATE = '2007-03-10T11:11:23'
SCANRES = 2400
SCANHCUT= 255
SCANLCUT= 0
SCANGAM = 1.00
SCANFOC = 0.00
DATE-OBS= '1956-03-18T21:19:00'
RA = '13:36:48'
DEC = '+10:46:00'
FOITNOX = 1950.00
```

#1 Band:Band Tr111.fits

File Stretch Type Histogram Source Defaults Options

Apply Stretch 9742 15642

Input Histogram



Current: Linear, Hist Source: Scroll [33,280 points]

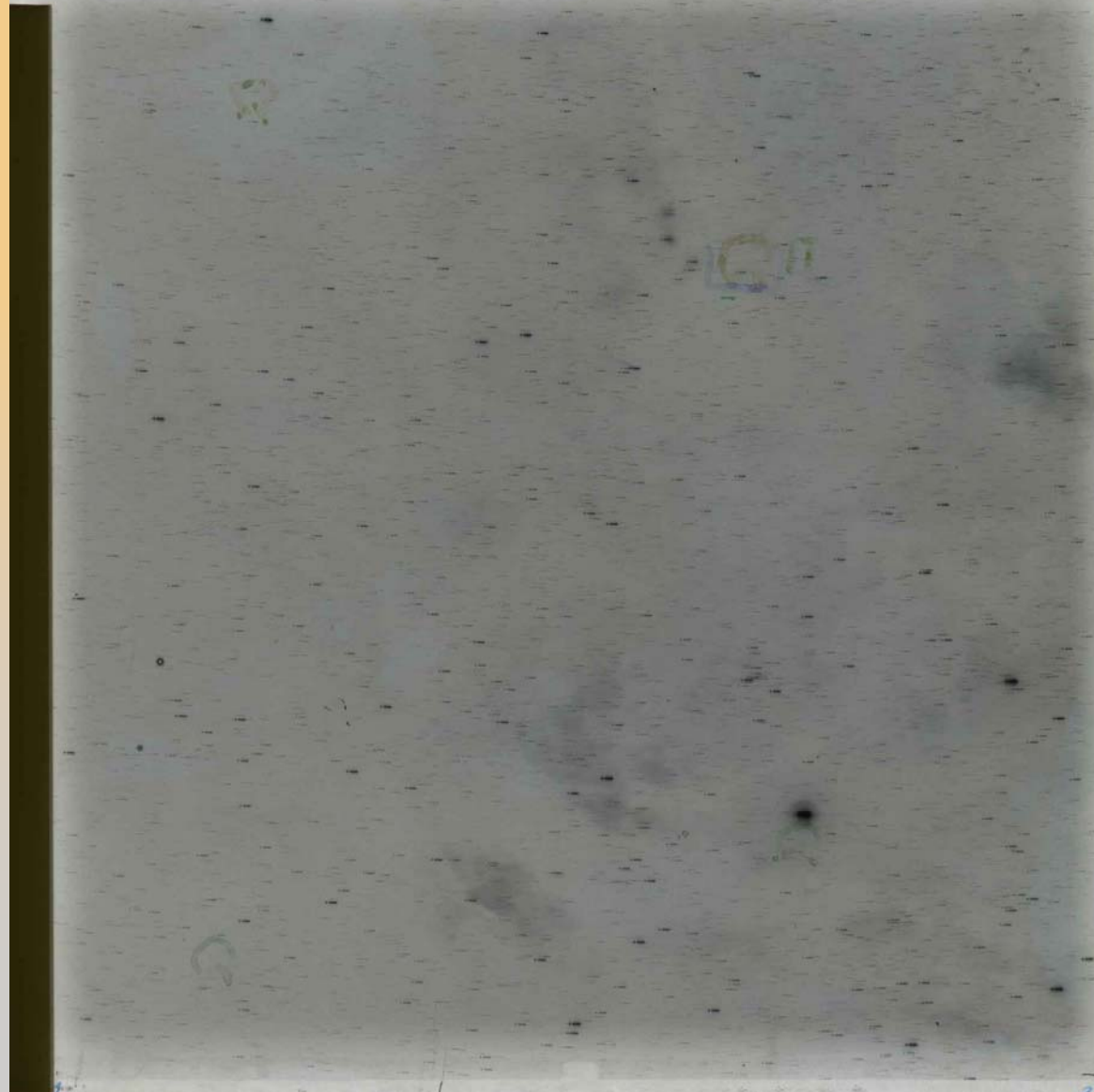
Platamonas, Greece, September 3-8, 2009

Wide-Field Plate Archiving: Scanned plates

ROZ050 000291

Gamma Cyg region

N: 291 8 Cygni . 11/12.10.80 . RA: 20^h 11^m 40^s . Gx10^m 24-21+UG2

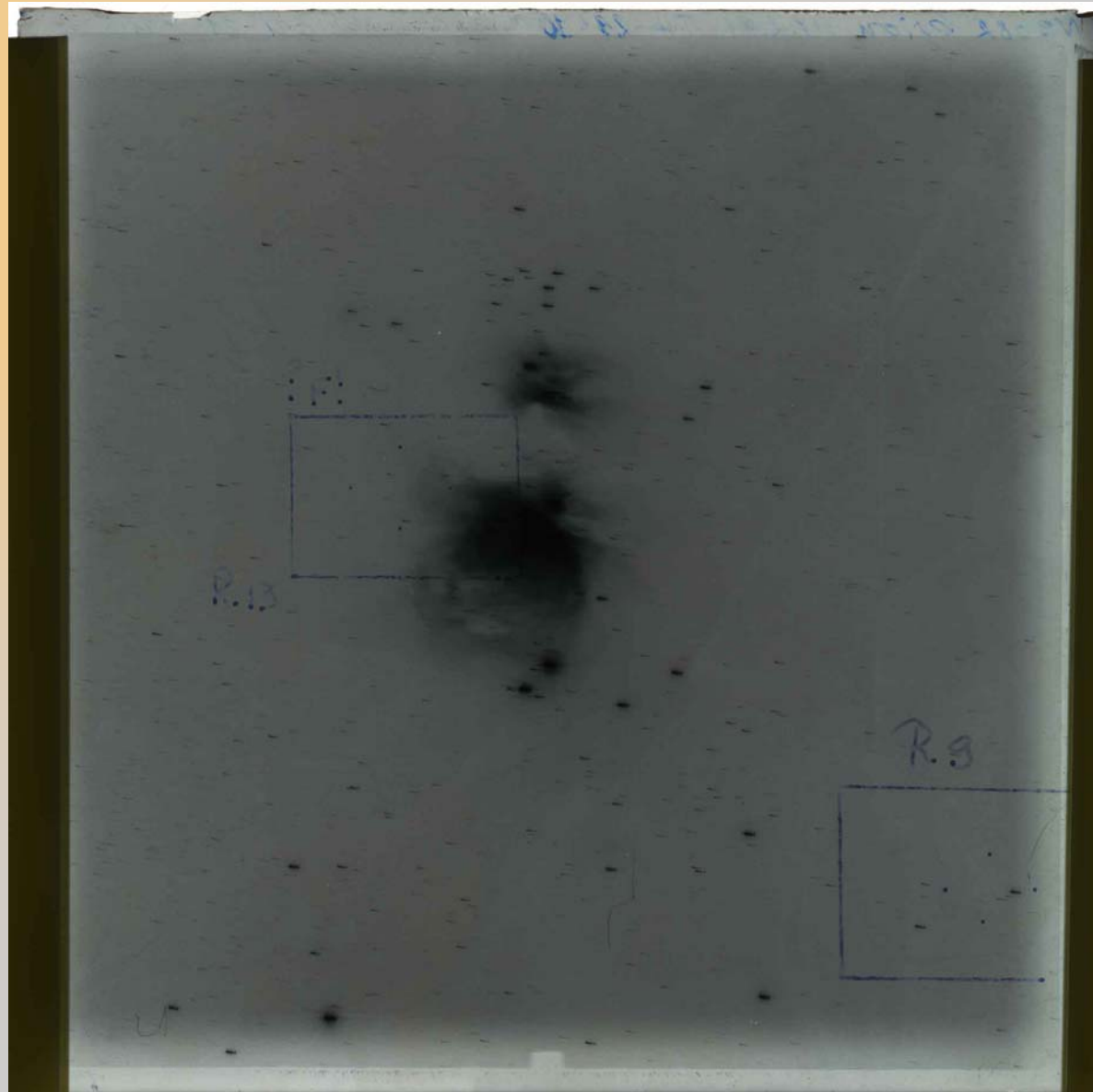


Platamonas, Greece, September 3-8, 2009

Wide-Field Plate Archiving: Scanned plates

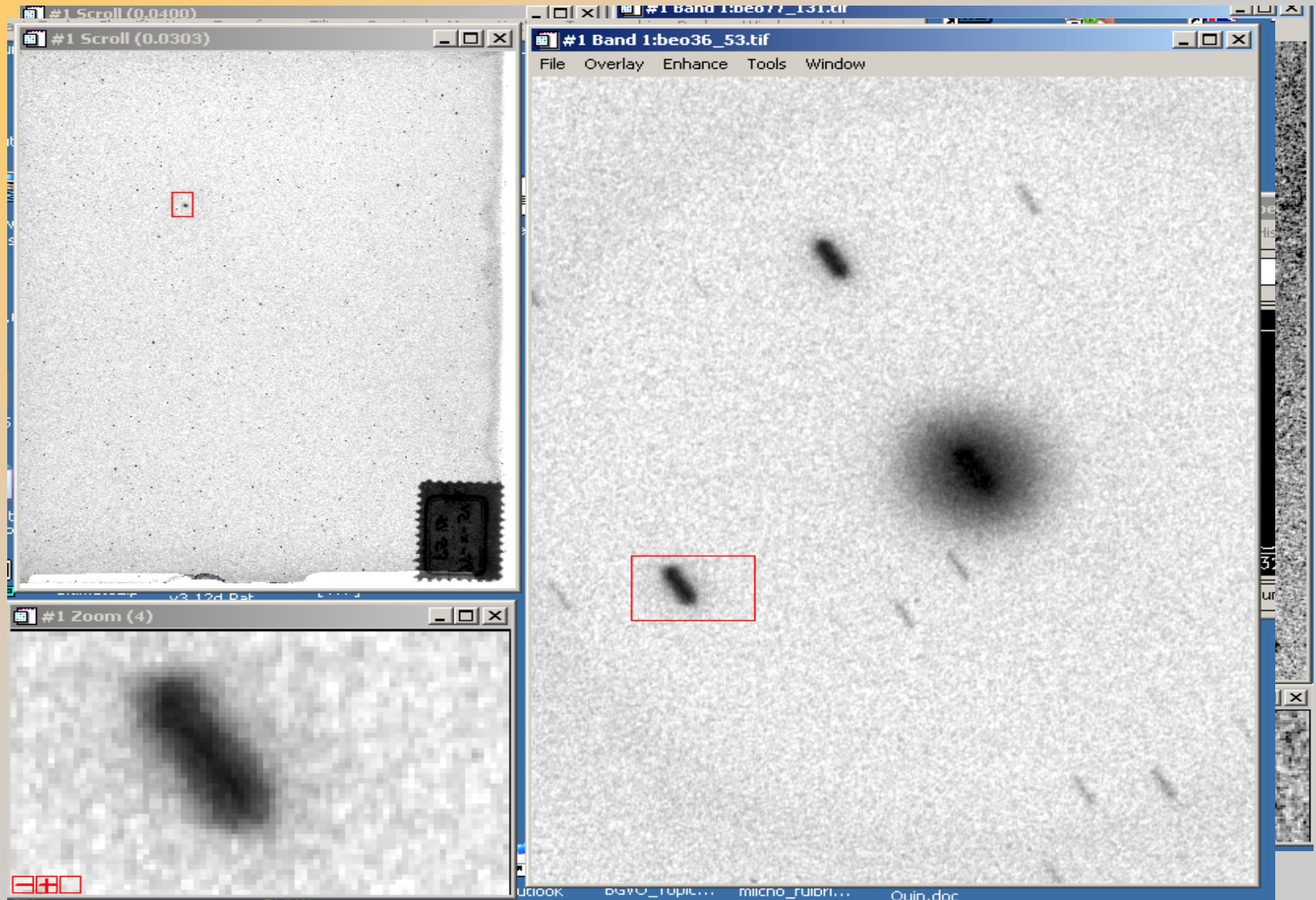
ROZ050 000383

M42/43 region



Platamonas, Greece, September 3-8, 2009

Wide-Field Plate Archiving: Scanned plates



Platamonas, Greece, September 3-8, 2009

Wide-Field Plate Archiving: Scanned Plates

BEL016A480007 (Comet 1948a, Mrkos)

Antonin Mrkos: 1947 Dec 20,
bad weather - not confirmed
Again observed on 1948 Jan 18

Milorad Protic: 1948 Jan 10



Wide-Field Plate Archiving: Digital Plate Archives

According to the main observing programmes:

Aims: to assemble and explore massive data sets in order to reveal a new knowledge existing in the data, but still not recognized in any individual data set.

Preparation of digital plate archives - as a part of the long-time programme for search, preservation and re-usage of the world wide-field photographic astronomical plate collections.

The last step before the systematic astronomical research: The organization of the plate scans in an image database and the development of a software system for object plate identifications and for searching in an image database with many data storage variants as current tasks. The

Wide-Field Plate Archiving: Digital Plate Archives: Examples

The Pleiades Plate Database - about 1500 plates giving the opportunity to obtain almost continuous photometric data set for the red dwarf stars in the cluster.

Flare Star Digital Archive – of representative plates obtained with the Schmidt telescopes of Konkoly and Rozhen observatories during the observation campaign for search and investigations of the flare stars in stellar clusters and associations in 1970-1990. Besides the primary aim to serve for investigations of the flare stars another result is the realization of an interlinking the electronic Information Bulletin on Variable Stars (IBVS) with the Wide-Field Plate Database (WFPDB).

Konkoly Supernova Digital Plate Archive (Tsvetkova et al. 2008, Baltic Astronomy) - observing programmes carried out with the 60/ 90/180 cm Schmidt telescope, started at the end of 1963, with which Konkoly Observatory for about more than a 30-year period took part in the international campaign initiated by F. Zwicky.

Carte du Ciel Digital Archives – Uccle (Tsvetkova et al. 2007), Potsdam (Tsvetkova et al. 2009, AN).

Wide-Field Plate Archiving: Collaboration

Topics:

- Cataloguing of wide-field photographic observations,
- Digitization of selected plates,
- Plate processing (with the routines supplied by IRAF software packages and IDL astronomy users library),
- Application of archived observations,
- Exchange of experience in development and application of astronomical databases (WFPDB and BELDATA) and organization of mirror sites of the databases.

Wide-Field Plate Archiving: Projects

- Between the Astronomical Observatory Belgrade and Space Research Institute, Bulgarian Academy of Sciences (2004 –2006);
- Between the Astronomical Observatory Belgrade and Institute of Astronomy, Bulgarian Academy of Sciences (2007 –2009).

Topic:

DEVELOPMENT AND APPLICATION OF ASTRONOMICAL DATABASES

Wide-Field Plate Archiving: Current Project

Working programme of the bilateral project of AO Belgrade (Serbia)
and Institute of Astronomy, BAS (Bulgaria)

- Preparation of plate catalogues for the wide-field photographic observations at AOB in the WFPDB format.
- Digitization of AOB plates.
- Inclusion of the plate catalogues in the WFPDB and in BELDATA.
- Estimation of the quality of the digitization data.
- Inclusion of the images of the scanned plates in WFPDB and BELDATA and online access.
- Organization of mirror sites.

Wide-Field Plate Archiving: Collaboration: Results

The information for the Belgrade plate archives is already included in the WFPDB.

An on-line access to this information for all the astronomical community through the VizieR facility in Strasbourg (since 1997, <http://vizier.u-strasbg.fr/cats/VI.htx>), and the WFPDB updated version in SSADC (<http://www.skyarchive.org>).

Project: Serbian Virtual Observatory (since February 2008).

The Belgrade Pleiades plates have been scanned and added to the archive of the scanned Pleiades plates (PPDB) aiming to reveal the long-term behaviour of some Pleiades stars.

Systematic plate scanning (up to August 2009 about 3000 plates).

Wide-Field Plate Archiving: Future Plans

- Acceleration of the plate logs cataloguing in Belgrade Observatory in a database format
- Reduction of the Belgrade wide-field plate catalogues in the WFPDB format. Analysis of the Belgrade plate catalogues based on the data retrieval from the WFPDB.
- Inclusion of the Belgrade plate catalogues in the WFPDB, as well as in BELDATA.
- Creation of archives of digitized Belgrade plates with low resolution for quick plate visualisation and their online access as a main priority.
- Scanning of selected Belgrade plates containing images of minor planets and comets as priority tasks.
- Organization of mirror sites for the both databases.
- Systematic scanning of AO Belgrade: Before the scanning: Making the preview images in TIFF and JPEG file format and linkage of the preview images to the WFPDB. Preparation for including the plate scans data into EURO VO - putting the data on the local server in AO Belgrade, a rough estimate of the scan data is about 1.5 TB.

Acknowledgements

Thanks to SOC and LOC for the invitation and excellent organization of the workshop Astrophysical Winds and Disks, Similar Phenomena in Stars and Quasars