

# Towards Kazakhstani Virtual Observatory Using Data Archive of the Fesenkov Astrophysical Institute

Ildana Izmailova

Fesenkov Astrophysical Institute

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# What we did at school?

We have studied such programs as

- CDS instruments;
- TOPCAT;
- STILTS;
- Aladin;
- MOC;
- HiPS

from the user's position. However, for my work it is necessary **to change the position**.

# Fesenkov Astrophysical Institute (FAI)

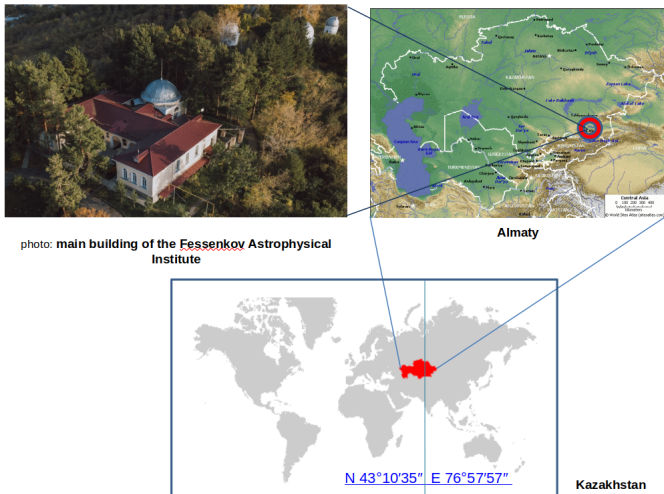


Figure: Location of FAI.

The Institute has an archive of plates - the Glass library. It consists of observational data for the period **1950-2000** and consists of about **20,000 plates**.

Data about each plate is stored in paper logs. This data is digitized into a [Digital Journal](#), which represents a table. All data in the table is entered **manually**.

# Complete frames

Data in header of each frame is taken from Digital Journal. So, complete frame is

digitized plates

+

data from Digital Journal

# Automatization of header writing

To automatization the writing of headers, we wrote a [script](#) in the Python programming language. It allows us

- to minimize the human factor;
- reduce the time required for writing header.

# Examples of headers

```

IC5446_12-13.09.1963_15m_3-2629.fits
File Edit Font
SIMPLE = T
BITPIX = 16 / 8 unsigned int, 16 & 32 int, -32 & -64 real
NAXIS = 2 / number of axes
NAXIS1 = 4269 / fastest changing axis
NAXIS2 = 4233 / next to fastest changing axis
BSCALE = 1.0000000000000000 / physical = BZERO + BSCALE*array_value
BZERO = 32768.000000000000 / physical = BZERO + BSCALE*array_value
INSTRUME = 'EPSON' / instrument or camera used
SWCREATE = 'SilverFast 8.0.1 r45 (Apr 24 2014) 7450a21 24.04.' / Name of software
INPUTFMT = 'TIFF' / Format of file from which image was read
XORGSUBF = 56 / Subframe X position in binned pixels
YORGSUBF = 136 / Subframe Y position in binned pixels
SWMODIFY = 'MaxIm DL Version 6.11 150610 155HR' / Name of software
SWSERIAL = '155HR-NNT55-W38JM-P32PS-MHYMR-82' / Software serial number
HISTORY Edit Crop
BAYERPAT = 'INVALID' / Indicates validity of image's Bayer pattern.
CSTRETCH = 'Moon' / Initial display stretch mode
CBLACK = 937 / Initial display black level in ADUS
CWHITE = 17527 / Initial display white level in ADUS
PEDESTAL = 0 / Correction to add for zero-based ADU
SWOWNER = 'Maxim Krugov' / Licensed owner of software
END

IC5446_12-13.09.1963_15m_3-2629.fits
File Edit Font
SIMPLE = T / FITS STANDARD
BITPIX = 16 / FITS BITS/PIXEL
NAXIS = 2 / NUMBER OF AXES
NAXIS1 = 4269 /
NAXIS2 = 4233 /
BSCALE = 1 / REAL = TAPE*BSCALE + BZERO
BZERO = 32768
ORIGIN = 'KPNO-IRAF' /
DATE = '2022-01-20T05:32:05' /
IRAFNAME = 'IC5446_12-13.09.1963_15m_3-2629.fits' / NAME OF IRAF IMAGE FILE
IRAF-MAX = 6.553500E4 / DATA MAX
IRAF-MIN = 1.400000E2 / DATA MIN
IRAF-BPX = 16 / DATA BITS/PIXEL
IRAF-TYPE = 'USHORT' / PIXEL TYPE
INSTRUME = 'EPSON' / instrument or camera used
SWCREATE = 'SilverFast 8.0.1 r45 (Apr 24 2014) 7450a21 24.04.' / Name of software
INPUTFMT = 'TIFF' / Format of file from which image was read
XORGSUBF = 56 / Subframe X position in binned pixels
YORGSUBF = 136 / Subframe Y position in binned pixels
SWMODIFY = 'MaxIm DL Version 6.11 150610 155HR' / Name of software
SWSERIAL = '155HR-NNT55-W38JM-P32PS-MHYMR-82' / Software serial number
HISTORY Edit Crop
BAYERPAT = 'INVALID' / Indicates validity of image's Bayer pattern.
CSTRETCH = 'Moon' / Initial display stretch mode
CBLACK = 937 / Initial display black level in ADUS
CWHITE = 17527 / Initial display white level in ADUS
PEDESTAL = 0 / Correction to add for zero-based ADU
SWOWNER = 'Maxim Krugov' / Licensed owner of software
IDN = '3-2629'
OBJECT = 'IC5446'
DATE-OBS = '1963-09-12T17:51:38.000'
EXPTIME = 900.0
OBJCTRA = '21:51:00.0'
OBJCTDEC = '47:01:12.0'
EPOCH = 1950
JD = 2438285.244189815
TELESCOPE = 'Wide aperture Maksutov meniscus telescope with main mirror 50 cm'
OBSERVER = 'Rozhkovskij D.A.'
OBSERVAT = 'FAI'
END
    
```

Figure: Header of frame before adding data via script (left) and after that (right).

As part of a large project, it is planned to create a Kazakhstan Virtual Observatory using

archive data

+

new observational data

of Fesenkov Astrophysical Institute.



# German Astrophysical Virtual Observatory (GAVO)

The German Astrophysical Virtual Observatory (GAVO) is the German contribution to the IVOA (International Virtual Observatory Association), the international effort to create and expand the Virtual Observatory (VO).



[www.g-v-o.org](http://www.g-v-o.org)

# Page on GAVO

Activities Firefox Web Browser Mar 11 2006

Table information for T... +  
https://dc.gvo.org/tableinfo/fai\_plates.main

## Table information for 'fai\_plates.main'

Help  
Service info

Metadata  
Identifier  
http://org.gvo.dc/fai\_plates.main  
Cite this  
Advice on citing this resource  
Description  
The archive of Plates  
Keywords  
History of astronomy  
Creator  
Izmailova, I.  
Created  
2022-03-02T09:36:00  
Data updated  
2022-03-03T10:21:25  
Metadata updated  
2022-03-03T10:21:25  
Source  
Ideally, a bibcode  
Reference URL  
Table information

**General**

This table is **not** available for [ADQL queries](#) and through the [TAP](#) endpoint.

**Resource Description:** The archive of Plates of the Fesenkov Astrophysical Institute (FAI) is an archive of digitized plates of the Institute's Glass Library. They represent the results of photometric and spectral observations for about 50 years - from 1950 to 2000.

For a list of all **services** and **tables** belonging to this table's resource, see [Information on resource 'Fesenkov Astrophysical Institute \(FAI\) Plate Archive'](#).

**Citing this table**

This table has an **associated publication**. If you use data from it, it may be appropriate to reference 'Ideally, a bibcode' either in addition to or instead of the service reference.

To cite the **table as such**, we suggest the following BibTeX entry:

```
@misc{vo:fai_plates_main,
  year=2022,
  title={Fesenkov Astrophysical Institute (FAI) Plate Archive},
  author={Izmailova, I. and Shoshkova, S. and Moshkina, S. and Umirbaeva, A.},
  url={https://dc.zah.uni-heidelberg.de/tableinfo/fai_plates.main},
  howpublished={IVO} resource provided by the {GAVO} Data Center
}
```

**Columns**

Sorted by DB column index. [\[Sort alphabetically\]](#)

Name	Table Head	Description	Unit	UCD
accret	Product key	Access key for the data	N/A	meta.ref.url
owner	Owner	Owner of the data	N/A	N/A
embargo	Embargo ends	Date the data will become/became public	a	N/A
mime	Type	MIME type of the file served	N/A	meta.code.mime
acsize	File size	Size of the data in bytes	byte	VOX:image_FileSize
centerAlpha	Ctr. RA	Approximate center of image, RA	deg	pos.eq.ra
centerDelta	Ctr. Dec	Approximate center of image, Dec	deg	pos.eq.dec
imageTitle	Title	Synthetic name of the image	N/A	meta.title
instrid	Instrument	Identifier of the originating instrument	N/A	meta.id.instr
dateObs	Obs. date	Epoch at midpoint of observation	d	time.obs.exposure

Try ADQL to query our data.  
ADQL Query  
URL

Figure: Main page of resource with data from FAI in GAVO.

# Search page

Activities Firefox Web Browser Mar 11 16:46

Fesenkov Astrophysical Institute (FAI) Plate Archive

Help Service info

Metadata

Identifier: [https://org.gavvo.de/fai\\_...](https://org.gavvo.de/fai_...)

Cite this: [Advice on citing this](#)

Description: The archive of Plates

Keywords: History of Astronomy

Creator: Izmailova, I.

Created: 2022-03-02T09:36:00

Data updated: 2022-03-03T10:21:25

Metadata updated: 2022-03-03T10:21:25

Source: [heavily, a tabcode](#)

Reference URL: [Service info](#)

Try ADOL to query our data.

FAI VO

Parameters

- Field size: 0.5
- Output format: imagefits

Result

Matched: 8

Send via SAMP Quick Plot



Product key	Type	File size [byte]	Ctr. RA [deg]	Ctr. Dec [deg]	Title	Instrument	Obs. date	axes	Axis Lengths [pix]	Scales [deg/pix]	Ref. Frame	Equinox [yr]	Proj.	Ref. pixel [pix]	Ref. values [deg]	CD matrix [deg/pix]	Bandpass	Bandpass unit
	imagefits	26.4MB	83.75	-5.23	FAI plate 7-1148	Wide aperture Maksutov meniscus telescope with main mirror 50 cm	1954-10-06T21:01:34Z	2	[3721, 3713]	[0.0006475, 0.0006475]	ICRS	NIA	TAN	[1861.0, 1857.0]	[83.75, -5.23]	[0.0006475, 7.929588e-20, 7.929588e-20, -0.0006475]		m
M42-NGC1376 <a href="#">Sh-2-281_06-07-10-1854_2h_7-1148.fits</a>																		
	imagefits	26.4MB	83.75	-5.23	FAI plate 7-1148	Wide aperture Maksutov meniscus telescope with main mirror 50 cm	1954-10-06T21:01:34Z	2	[3721, 3713]	[0.0006475, 0.0006475]	ICRS	NIA	TAN	[1861.0, 1857.0]	[83.75, -5.23]	[0.0006475, 7.929588e-20, 7.929588e-20, -0.0006475]		m

Figure: Page with search results of resource with data from FAI in GAVO.

The coordinates of the objects on the astroplates have an **equinox B1950.0**. Therefore, when opening fits files in Aladdin, we observe an **offset in coordinates**.

# Issue with coordinates. Aladin (1).

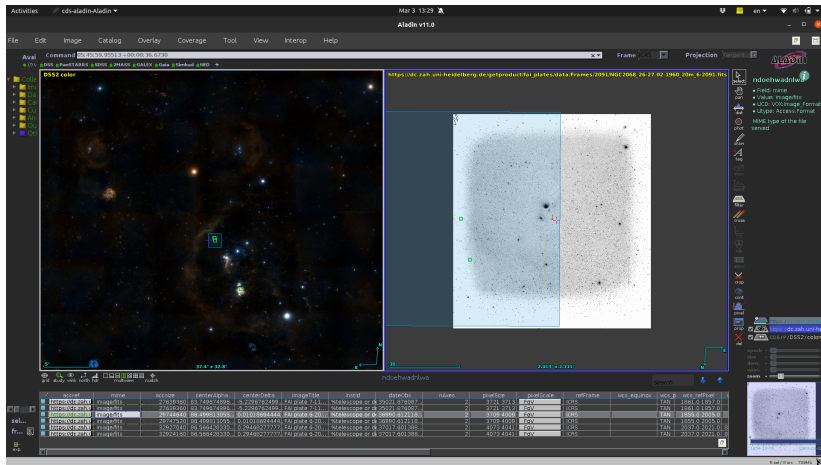


Figure: The shift of the square (blue) showing the coverage of the area in the sky relative to the frame itself.

# Issue with coordinates. Aladin (2).

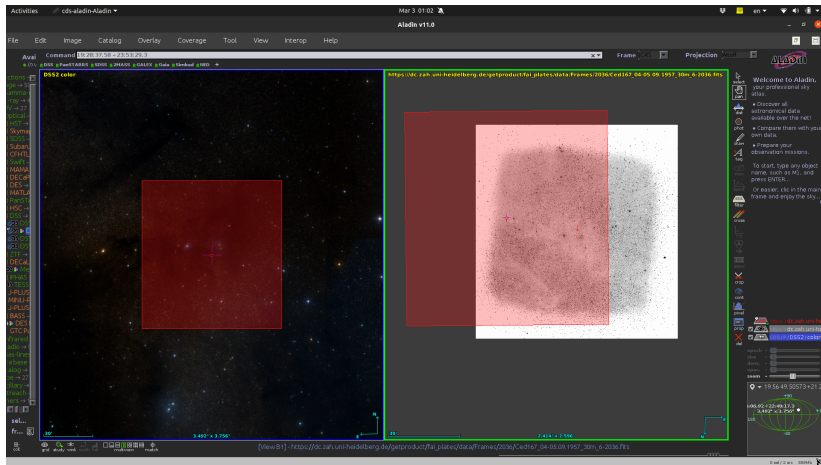


Figure: The shift of the square (red) showing the coverage of the area in the sky relative to the frame itself

# Conclusion

- Participation in this school has greatly expanded the range of opportunities in scientific work. Of course, all the knowledge gained will be applied in the future.
- Work on the creation of a Virtual Observatory will continue.

Thank you for your attention!