



Ulugh Beg Astronomical Institute  
Uzbekistan Academy of Sciences

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**UZBEK-CHINESE  
COOPERATION ON UBAI  
PHOTOGRAPHIC ARCHIVE  
PLATE DIGITIZATION**

6<sup>th</sup> MAIDANAK USERS MEETING  
1-3 November 2021, UBAI, Tashkent Uzbekistan

# Ulugh Beg Astronomical Institute Plate Archive

The photographic plate archive of UBAI consists of two parts:

1. Tashkent

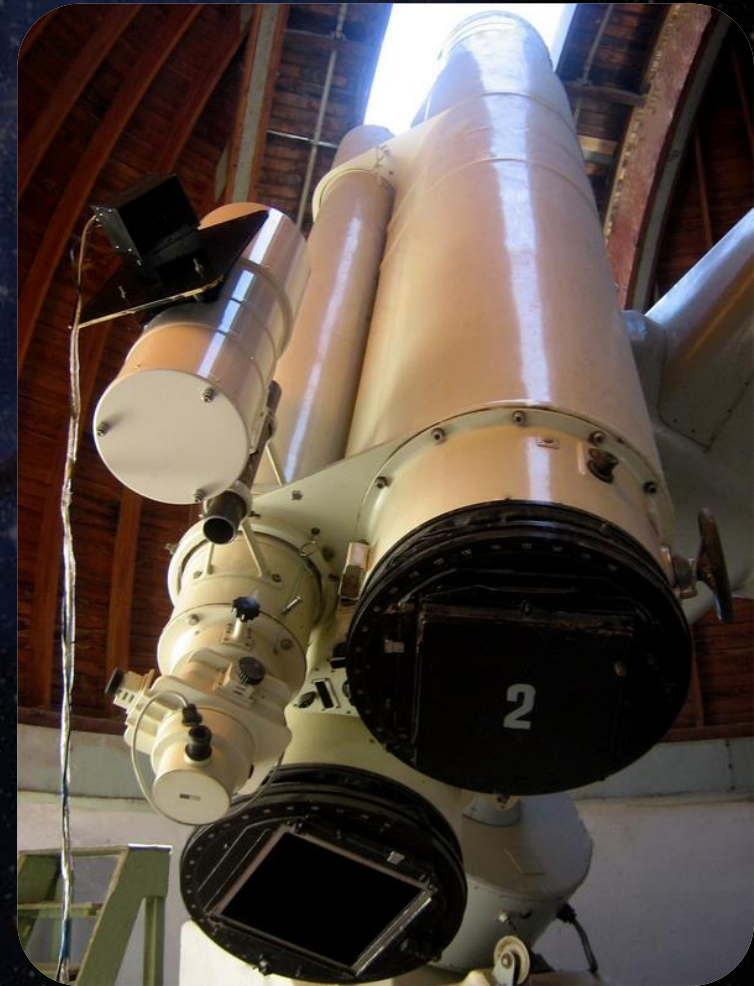
2. Kitab



**Normal Astrograph in Tashkent**  
(observations were carried out  
within 1895-1986)

**Double Astrograph of Zeiss in  
Kitab**

Observations were carried out  
within 1975-2004

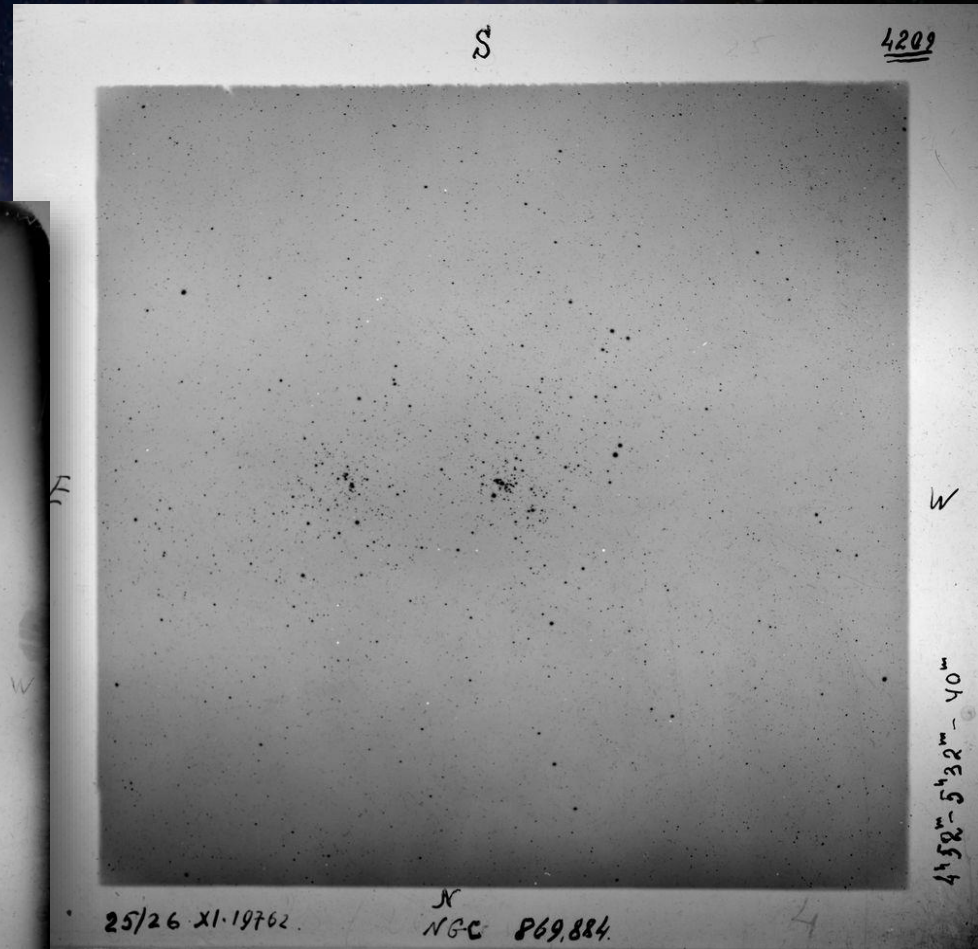
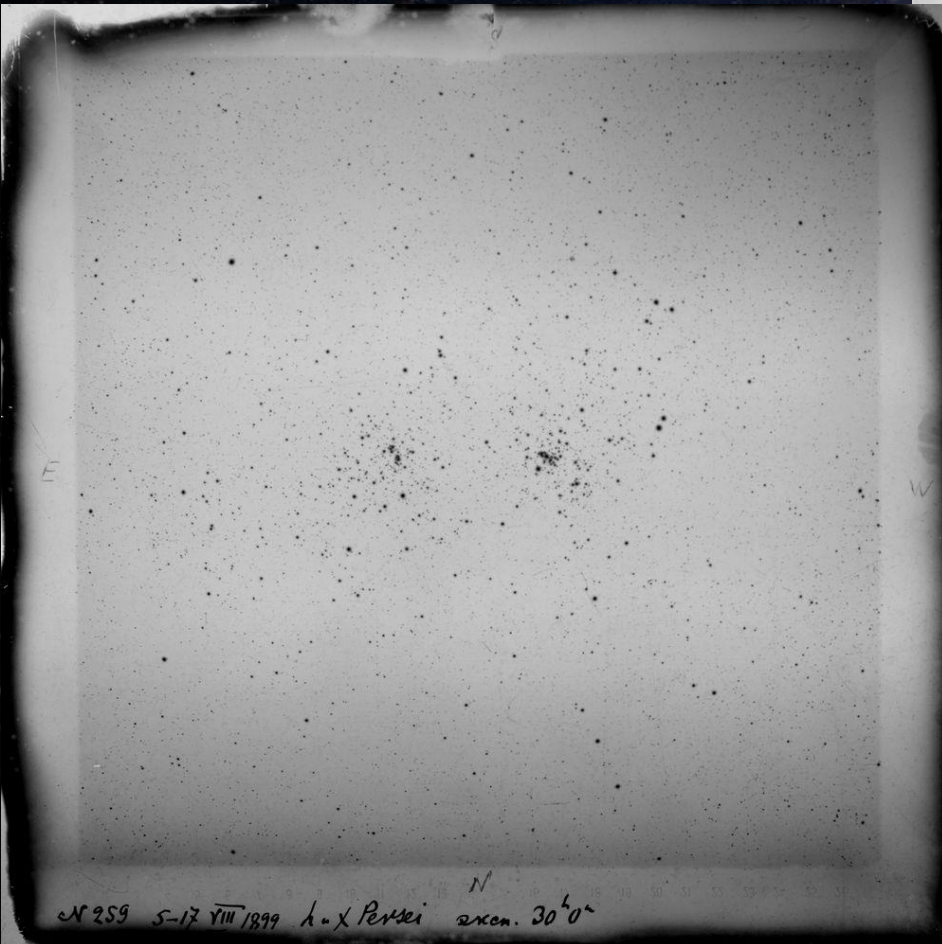


# Main characteristics of the Normal Astrograph and Double astrograph of Zeiss

Parameter	TNA	Kitab DAZ
ID	TAS033	TAS040A (tube1) & TAS040B (tube2)
Code of the observatory	192	186
Longitude	69° 17'.0	66° 53'.0
Latitude	41° 19'.5	39° 08'.0
Altitude	482 m	690 m
Aperture	0.33 m	0.40 m
Focal length	3.43 m	3 m
Scale	60"/mm	69"/mm
FOV	2° ÷ 2.5°	5.5° ÷ 6.0°
Glass plate size (max)	16x16 cm	30x30 cm

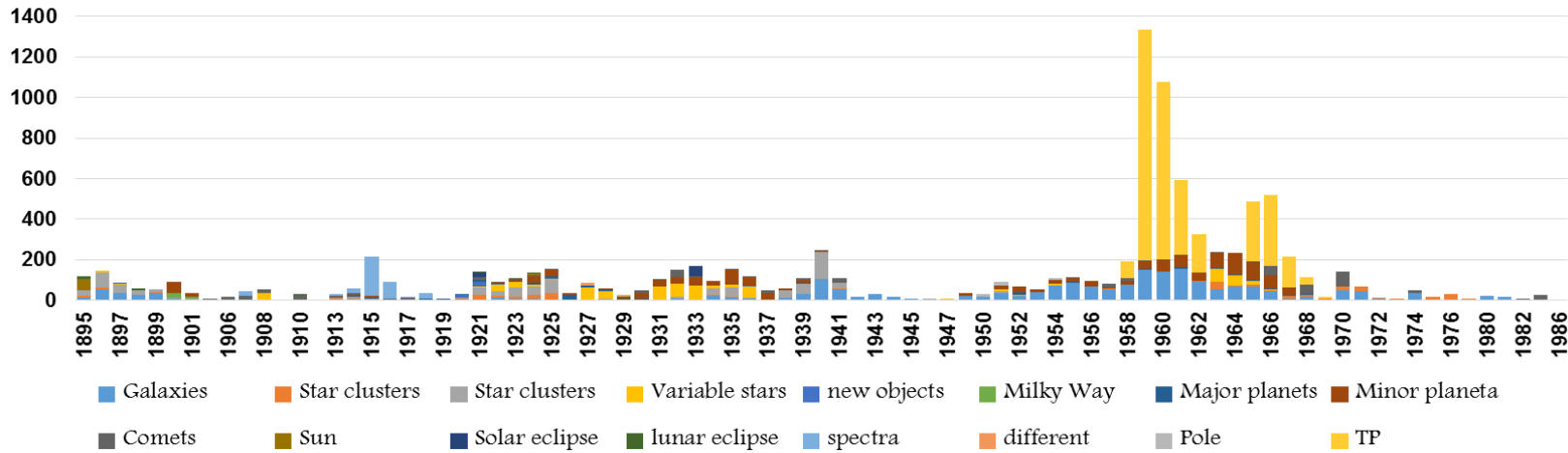
# $\chi$ and h of Perseus

05-17.08.1899  
expos: 30 hours

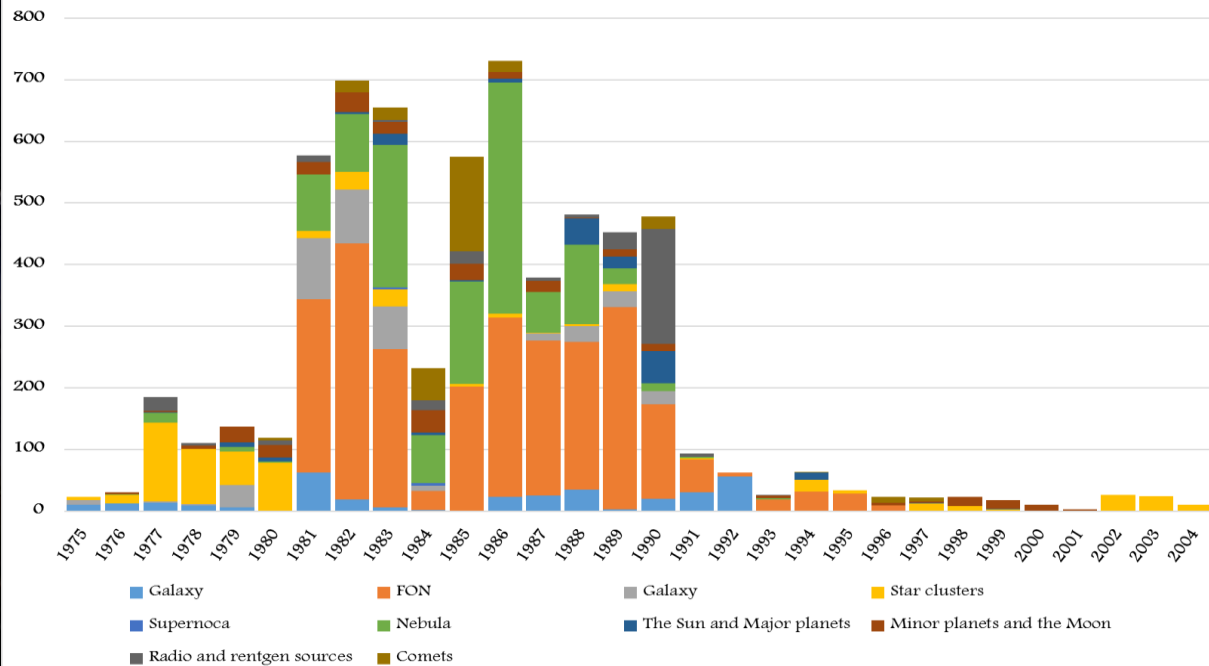


25.11.1976  
expos: 40 min

# Observations on Normal Astrograph at Tashkent Astronomical Observatory (TAO)



# Observations on DAZ at Kitab Observatory (Uzbekistan)



# **UBAI project on digitization of the photographic archive**

**In 2014 a project on sprucing up and digitization of the photographic archive started at UBAI.**

**Five main tasks were under consideration:**

- **Collecting all plates in UBAI in specially equipped room.**
- **Dispatching plates to closets according to dates and programs.**
- **Classification of plates according to WFPDB standard.**
- **Choosing appropriate method and digitization of plates.**
- **Scientific analyses of the material.**





# Classification of plates

Plate Archive information database has made according to Wide-Field Plate Database (WFPDB) format.

ID obs	ID ins	ID suf 1	ID no	ID suf 2	RA			DE			CCOD	DATE			UT			TCOD	
A3	I3	A1	I6	A1	I2	I2	I2	A1	I2	I2	I2	A1	I4	I2	I2	I2	I2	I2	A1
	cm	A-Z	P NO	A-Z	H	M	S	SIGN	D	M	S	char	Y	M	D	H	M	S	EMU
Kitab ast. Obs.	40	DAZ	000668	B	09	43	0	-	20	47	00		1981	02	04				
Kitab ast. Obs.	40	DAZ	000668	A	09	43	42	-	20	47	00		1981	02	04				
Kitab ast. Obs.	40	DAZ	000661	B									1981	02	31				
Kitab ast. Obs.	40	DAZ	000661	A									1981	02	31				
Kitab ast. Obs.	40	DAZ	000833	B	02	39	18	+	38	57			1981	09	28				
Kitab ast. Obs.	40	DAZ	001007	B	02	39	18	+	38	57			1982	12	09				
Kitab ast. Obs.	40	DAZ	001007	A	02	39	18	+	38	57			1982	12	09				
Kitab ast. Obs.	40	DAZ	000833	A	02	39	18	+	38	57			1981	09	28				
Kitab ast. Obs.	40	DAZ	001026	A	09	11	30	-	24	05			1982	12	13				
Kitab ast. Obs.	40	DAZ	000962	B	18	47	12	+	45	33			1982	09	10				
Kitab ast. Obs.	40	DAZ	000791	A	18	47	12	+	45	33			1981	08	06				
Kitab ast. Obs.	40	DAZ	000962	A	18	47	12	+	45	33			1982	09	10				
Kitab ast. Obs.	40	DAZ	000791	B	18	47	12	+	45	33			1981	08	06				
Kitab ast. Obs.	40	DAZ	000963	B	18	47	12	+	45	33			1982	09	11				
Kitab ast. Obs.	40	DAZ	000963	A	18	47	12	+	45	33			1982	09	11				

OBJNAM	OBJTYP	METHOD	MULTEX	EXP	EMULS	FILT	SPEC	DIMx	DIMy	PQUAL	PNOT	POBS	PAVA	PDIG
A20	A2	I2	I2	F6.1	A11	A7	A2	I2	I2	I1	I1	I1	I1	I1
NAME	A1-F	1-24	[1-3]	min			SPEC BAND	cm	cm	0-1	0-1	0-1	0-9	0-1
NGC-2983	G1			40.0	ORWO ZU21			30	30					
NGC-2983	G1			40.0	ORWO ZU21			30	30					
NGC-1600	G1			40.0	ORWO ZU21			30	30					
NGC-1600	G1			40.0	ORWO ZU21			30	30					
NGC-1023	G1			45.0	ORWO ZU21			30	30					
NGC-1023	G1			45.0	ORWO ZU21			30	30					
NGC-1023	G1			45.0	ORWO ZU21			30	30					
NGC-1023	G1			45.0	ORWO ZU21			30	30					
NGC-2784	G1			45.0	ORWO ZU21			30	30					
NGC-6703	G1			40.0	ORWO ZU21			30	30					
NGC-6703	G1			60.0	ORWO ZU21			30	30					
NGC-6703	G1			50.0	ORWO ZU21			30	30					
NGC-6703	G1			60.0	ORWO ZU21			30	30					
NGC-6703	G1			40.0	ORWO ZU21			30	30					
NGC-6703	G1			50.0	ORWO ZU21			30	30					

## Digitization of plates

Digitization of the photographic plates were carried out using Epson Expression 10000XL flatbed scanner with the spatial resolution of 1200 dpi.



# FON project

FON is russian aberration of Photographic Sky Survey



*Abastumani  
(Georgia)*



*Zvenigorod  
(Russia)*



*Kazan-Zelenchuk  
(Russia)*



*Kyiv  
(Ukraine)*



*Dushanbe  
(Tajikistan)*



*Kitab  
(Uzbekistan)*

- Telescope: Double Astrograph of Zeiss (D=40 sm, F=2-3 m);
- Activity: 1980-1996;
- Plate size and emulsion type: 30x30 sm, ORWO ZU21.

## 2600 Astronegatives:

- ~ 1960 photographic plates: declination  $0^\circ \sim -20^\circ$ ;
- ~ 640 photographic plates: in the range  $0^\circ \sim +28^\circ$ .

## Participants:

Ulugh Beg Astronomical Institute of the UzAS (Uzbekistan) - Q. Yuldoshev;  
MAO NAS Ukr (Ukraine) - V.M. Andruk;  
Nikolaev Astronomical Observatory (Ukraine) - Yu.I. Protsyuk;  
Walter-Hohmann Observatory (Germany) - E. Relke.



$\alpha = 15^h - 21^h$

540 plates



$0^h - 3^h, 21^h - 24^h$

~ 480



$3^h - 6^h, 12^h - 15^h$

~ 530



$6^h - 12^h$

~ 400

## About the catalogue

The Kitab's catalogue of FON project contains near 13.4 million stars and galaxies down to the 17.<sup>m</sup>5 on the epoch 1985.0.

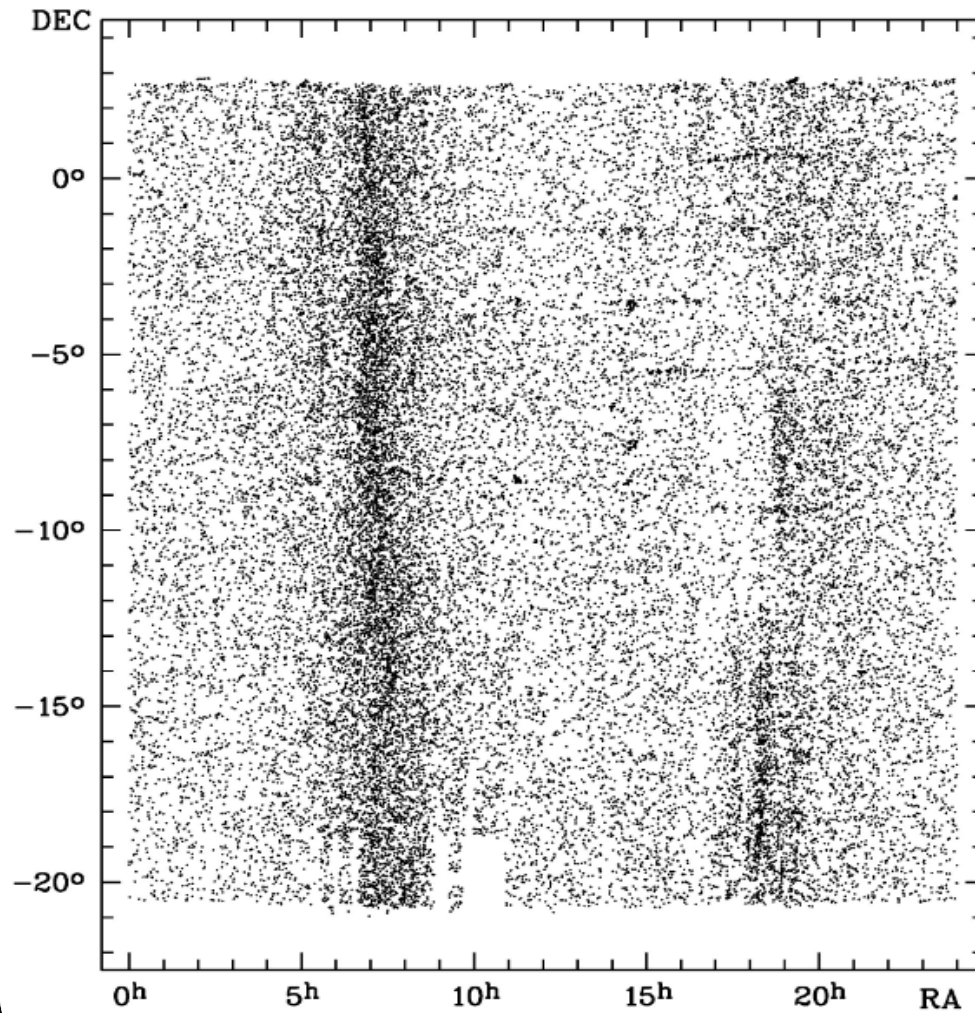
The coordinates of stars and galaxies have been obtained in the system of Tycho-2 catalogue, B-magnitudes in the system of photoelectric standards.

The internal accuracy of the catalogue for all objects is  $\sigma_{\alpha\delta}=0.''23$  and  $B=0.^m15$ . For the stars in the interval  $B = 5^m \div 14^m$  the errors are equal to  $\sigma_{\alpha\delta}=0.''085$  and  $\sigma_B=0.^m054$ .

The convergence of calculated coordinates with Tycho-2 reference catalogue is 0.''042 (for the 356 665 stars), the convergence with the photoelectric B-magnitudes of stars is 0.<sup>m</sup>16 (for the 6719 stars). The errors relative to the UCAC4 catalogue are 0.''26 for the 9 892 697 (73.75%) identified stars and galaxies.

# SKY AREA OF FON-KITAB (FONAC-S) CATALOGS

FON-KITAB, DAZ, B=09.5-10.5 mag  
sigma RA, DEC, Bmag = 0.225, 0.234, 0.154  
N=1960, K=13413268(12155699), Ep=1984.97



## Links for the catalogue

<ftp://cdsarc.u-strasbg.fr/pub/cats/I/346>

<https://cdsarc.unistra.fr/viz-bin/cat/I/346>

<http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=I/346>



Portal

Simbad

VizieR

Aladin

X-Match

Other ▾

Help

**I/346** FON Astrographic Catalogue Southern Part (FONAC-S) (Yuldoshev+, 2017)

Catalog of Equatorial Coordinates and B- Magnitudes of Stars of the Kitab Part of the FON Project.

Yuldoshev Q.X., Ehgamberdiev Sh.A., Muminov M.M., Protsyuk Yu.I., Relke H., Andruk V.M.

<Kinem. and Physics of Celest. Bodies. 33, 250 (2017)>

[=2017KPCB...33..250Y](#)

[=2017KFNT...33..250Y](#)

[=2018yCat.1346....0Y](#)

**ADC\_Keywords:** Positional data ; Magnitudes, photographic ;  
Photographic catalog ; Photometry, photographic

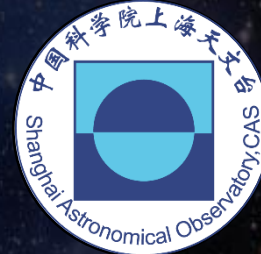
**Keywords:** catalog: positions: stars, galaxies -  
photometry: photographic, B magnitudes -  
plate data: image processing - database: digital archive

Yuldoshev, Q. X., Ehgamberdiev, Sh. A., Muminov, M. M., Protsyuk, Yu. I., Relke, H., Andruk, V. M., VizieR Online Data Catalog: FON Astrographic Catalogue Southern Part (FONAC-S), VizieR On-line Data Catalog: I/346. 2018.

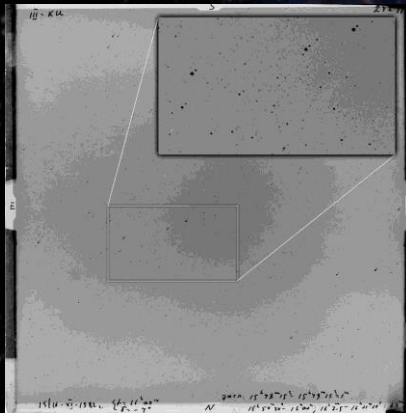
# PRESENT AND FUTURE WORKS



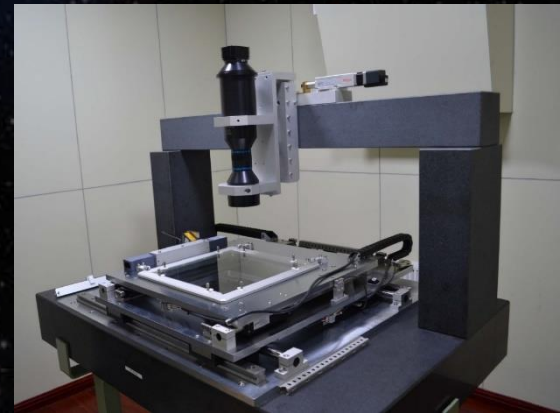
**Uzbek-Chinese project**



*Digitization of the UBAI astroplates using the SHAO digitizing machine and studying long-term behavior of selected astronomical objects*



**Duration: 2021-2022**





**Agreement for Scientific Cooperation between  
Shanghai Astronomical Observatory and Ulugh Beg Astronomical Institute**

The goal of the agreement is to build collaboration between the Shanghai Astronomical Observatory of Chinese Academy of Sciences (SHAO/CAS) and the Ulugh Beg Astronomical Institute of the Uzbekistan Academy of Sciences (UBAI/UAS) in the fields of plate digitization and joint researches based on the digitized data.

Before 2000, photographic plates had been the main receiver of optical telescopes since 1850s. There are about 3 million photographic plates in the world which were taken by telescopes all over the world in the 150 years. Each plate is the only record of the sky at the epoch of time when it was taken and it includes irreplaceable scientific information which is very important to research of time domain astronomy.

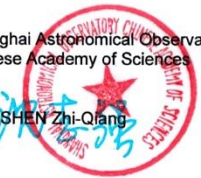
Both sides have good experience of plate digitization and big plate archives. SHAO/CAS has developed a fast and precise digitizing machine during 2012-2015. The machine was used to digitize all Chinese plates (~30,000) during 2016-2017. All data from digitization has been stored in Chinese Virtual Observatory (CVO), astronomers all over the world can use the data to do research through visiting CVO. UBAI/UAS has started its plate digitization project since 2014, some plates have been digitized by EPSON 10000XL scanner. In April of 2018, some plates of UBAI/UAS were carried to SHAO/CAS for test digitization and comparison. Considering digitizing machine of SHAO/CAS will be free since July of 2018, both sides agreed to cooperate in digitizing all plates of UBAI/UAS in the future. To make this cooperation work well, both sides agree to carry out the following tasks respectively:

- (1) UBAI/CAS will finish catalogue of all plates before the end of 2018.
- (2) SHAO/CAS will prepare special place to hold plates of UBAI/UAS before the end of 2018.
- (3) UBAI will finish package all plates before the end of 2018 under the technical support of SHAO/CAS.
- (4) Both sides will develop special software to analyze digitized images of plates jointly from August 2018 to July 2019.
- (5) Both sides will do joint research on common interests based on digitized data of plates of both sides after UBAI/UAS plates had been digitized.
- (6) Both sides will apply special support for this project. If UBAI/UAS could not get the support, SHAO/CAS will help UBAI/UAS to pack and transport the plates to Shanghai.

This agreement is valid from August 1, 2018 to December 31, 2021. It can be revised and extended further by mutual agreement. Signed in two copies in English, each of them having the same faith, in July 22, 2018.

Shanghai Astronomical Observatory  
Chinese Academy of Sciences

Prof. SHEN Zhi-Qiang



Ulugh Beg Astronomical Institute  
Uzbekistan Academy of Sciences

Dr. Sc. Shuhrat Ehgamberdiev



**MEMORANDUM OF UNDERSTANDING ON  
SCIENTIFIC AND INSTRUMENTAL COLLABORATIONS  
BETWEEN ULUGH BEG ASTRONOMICAL INSTITUTE (UBAI),  
UZBEKISTAN ACADEMY OF SCIENCES AND  
SHANGHAI ASTRONOMICAL OBSERVATORY (SHAO),  
CHINESE ACADEMY OF SCIENCES**

Ulugh Beg Astronomical Institute, Uzbekistan Academy of Sciences (UBAI) and Shanghai Astronomical Observatory of the Chinese Academy of Sciences (SHAO) (hereinafter referred to as "the Parties") discussed to build collaboration between the Parties on the fields of plate digitization and joint research based on the digitized data.

UBAI has about 15000 photographic plates of the sky which need to be digitized before scientific analyses with computers. SHAO had developed specialized high-precision machine for digitization astronomical plates.

In 2021, taking into account mutual benefit from such collaboration Ministry of Innovative Development of the Republic of Uzbekistan and Ministry of Science and Technology of People's Republic of China in the framework of Uzbek-Chinese cooperation science and technology supported joint project on "Digitization of the UBAI astroplates using the SHAO digitizing machine and studying long-term behavior of selected astronomical objects".

The Parties have approved the following agreement on plate digitization and scientific collaborations and have agreed on the following:

UBAI will send its photographic plates to Shanghai for digitization on high-precision machine of SHAO.

SHAO will prepare special boxes in factory and send to Uzbekistan for further

transportation to China of astronomical plates of UBAl.

SHAO will digitize UBAl's plates with SHAO digitizing machine and send them back in special boxes.

UBAl will use boxes of SHAO for the next set of astroplates for sending to SHAO.

Transportation expenses will be paid by both parties.

The deals with national customs issues will be done by the Parties.

The Parties will work on developing special software to analyze digitized images of plate jointly, comparison of digitization quality and accuracy of two scanners and preparation a paper based on the results of the comparison.

The Parties will do joint research on common interests based on digitized data of plates of the Parties after UBAl plates had been digitized.

Every journal and other official publication resulting from the output involving the usage of the astroplates of UBAl must at least include one co-author each from UBAl and SHAO, and UBAl and SHAO must be specifically included as their institutions in those publications. The Parties will protect the intellectual property rights related to the output of joint research programs. These outputs will not be used for obtaining patents or for benefits of one party without the prior approval of the other party.

This Memorandum is valid from April 1, 2021 to December 31, 2024. It can be revised and extended further by mutual agreement. Signed in two copies in English, each of them having the same faith, in May 10, 2021.

Shanghai Astronomical Observatory  
Chinese Academy of Sciences

Prof. SHEN Zhi-Qiang



Ulugh Beg Astronomical Institute of  
Uzbekistan Academy of Sciences

Academician Shuhrat Ehgamberdiev



## ADDENDUM I

### TO THE MEMORANDUM OF UNDERSTANDING ON SCIENTIFIC AND INSTRUMENTAL COLLABORATIONS

signed on May 10, 2021 between

ULUGH BEG ASTRONOMICAL INSTITUTE (UBAI),  
UZBEKISTAN ACADEMY OF SCIENCES AND  
SHANGHAI ASTRONOMICAL OBSERVATORY (SHAO),  
CHINESE ACADEMY OF SCIENCES

Ulugh Beg Astronomical Institute, Uzbekistan Academy of Sciences (UBAI) and Shanghai Astronomical Observatory of the Chinese Academy of Sciences (SHAO) (hereinafter referred to as "the Parties") discussed to build collaboration between the Parties on the fields of plate digitization and joint research based on the digitized data.

#### 1. Responsibilities of UBAl

The Astronomical Institute will send the astronomical photographic plates to Shanghai for digitization on a high-precision digitizing machine of the SHAO.

Description of Goods	HS code	Quantity	Amount USD	Net Wight kg
Photographic plates	3701990000	10000	10 000	1500

#### 2. Responsibilities of SHAO

SHAO will special boxes for astronomical photographic plates and send them to Uzbekistan for further transportation of UBAl astronomical photographic plates to China.

Description of Goods	HS code	Quantity	Amount USD	Net Wight kg
Special boxes for astronomical photographic plates	7326 90 920 9	80	1600	960

*\*NOTE: Non-commercial value. The indicated value is for customs purposes only. Changes in quantity and prices are possible.*

This ADDENDUM I should be considered as internal part of the MEMORANDUM and valid from April 1, 2021 to December 31, 2024.

Shanghai Astronomical Observatory  
Chinese Academy of Sciences

Prof. SHEN Zhi-Qiang  
Director of SHAO/CAS



沈志强

Ulugh Beg Astronomical Institute of  
Uzbekistan Academy of Sciences

Academician Shuhrat Ehgamberdiev



# TEAMS OF THE PROJECT

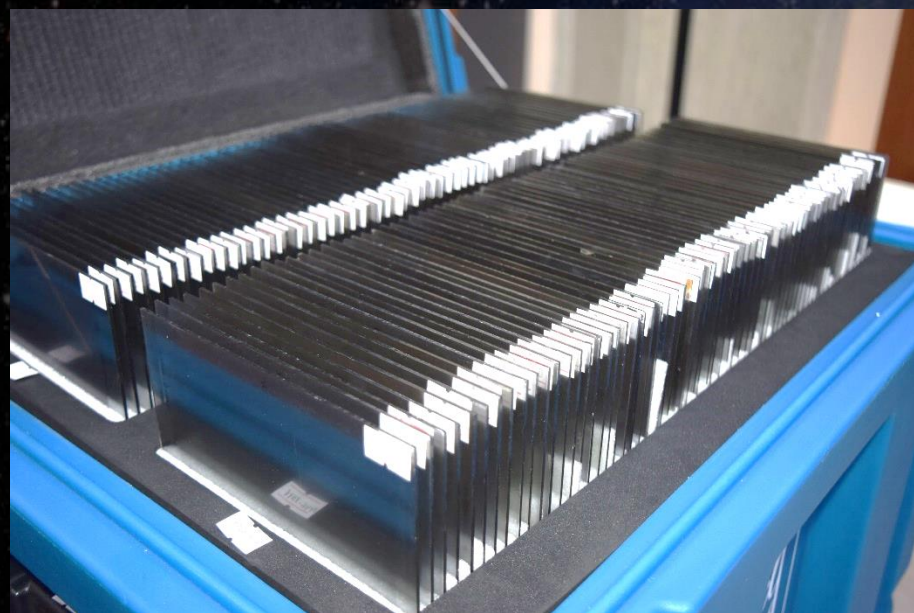
## Uzbekistan

Qudrat YULDOSHEV  
Shuhrat EHGAMBERDIEV  
Sobir TURAYEV  
Aktam HAFIZOV  
Muydin MUMINOV  
Abbos OMONOV  
Burkhon ABIDKHANOV

## China

TANG Zheng-Hong  
YU Yong  
ZHAO Jian-Hai  
LIU Chang-Shun  
CHEN Zhen-Dong  
SHANG Zheng-Jun  
WANG Liang-Liang





## **According to the agreement and the memorandum the following works will be done in the project:**

- Systemization of the astroplate archive;
- Classification of plates according to WFPDB standard;
- High precision digitization of UBAI astronomical negatives;
- Processing software for the astronomical plates with the ability of information extraction and star image recognition;
- Prepare the catalogs of the stars and other objects;
- Define the proper motions of the objects;
- Photometric measurements and estimation of objects' brightness;
- Revealing open clusters, Extragalactic objects (galaxies) etc.;
- Deep scientific analyses of the obtained database;
- Insert existed database into the Virtual Observatory and Astronomical plate database shared by China and Uzbekistan.



**Open clusters from Maidanak data**

**Thanks for your attention!**



**Acknowledgement:  
Khotam SULTANOV (UZ)  
EVA (CN)**