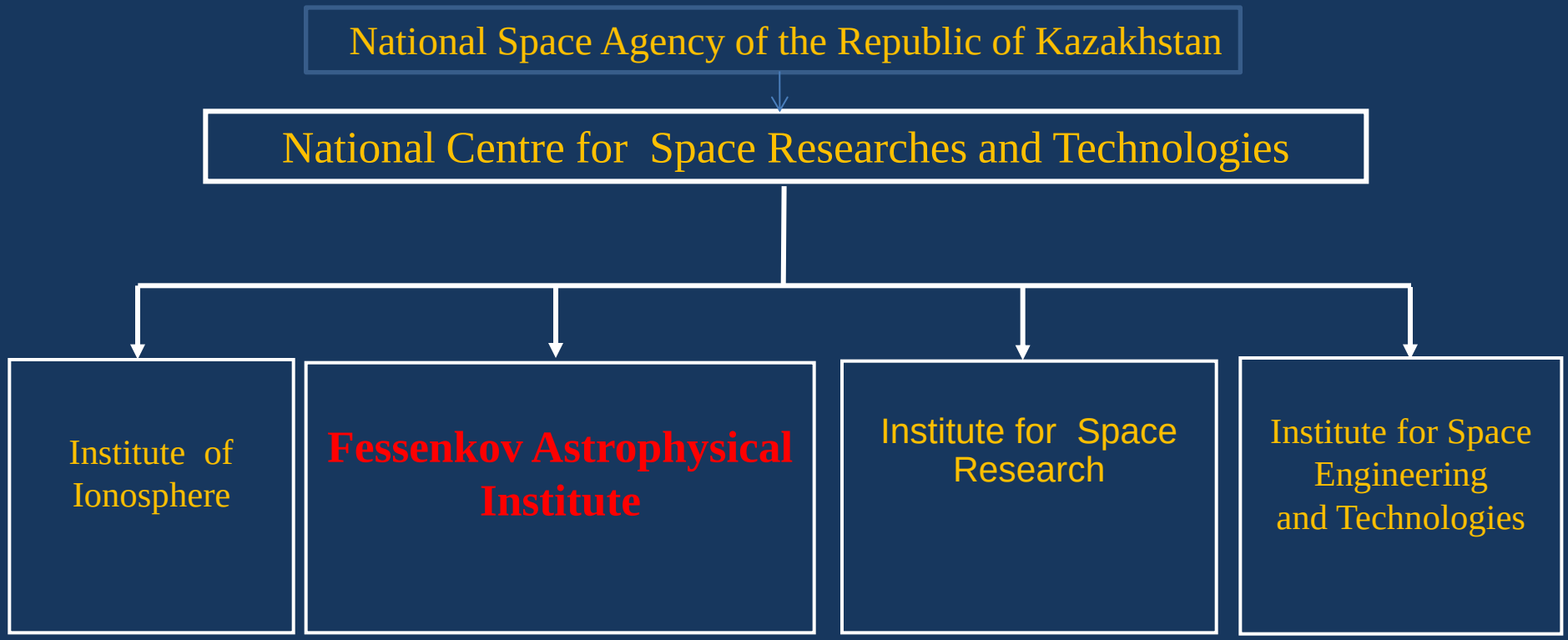
NATIONAL SPACE AGENCY OF THE REPUBLIC OF KAZAKHSTAN

Fessenkov Astrophysical Institute

Dr. Chingis Omarov

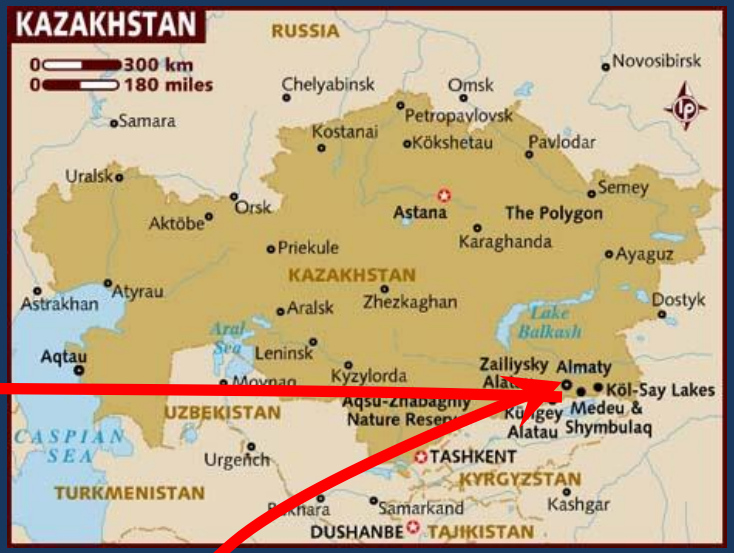
Paris, November 2014

THE STRUCTURE



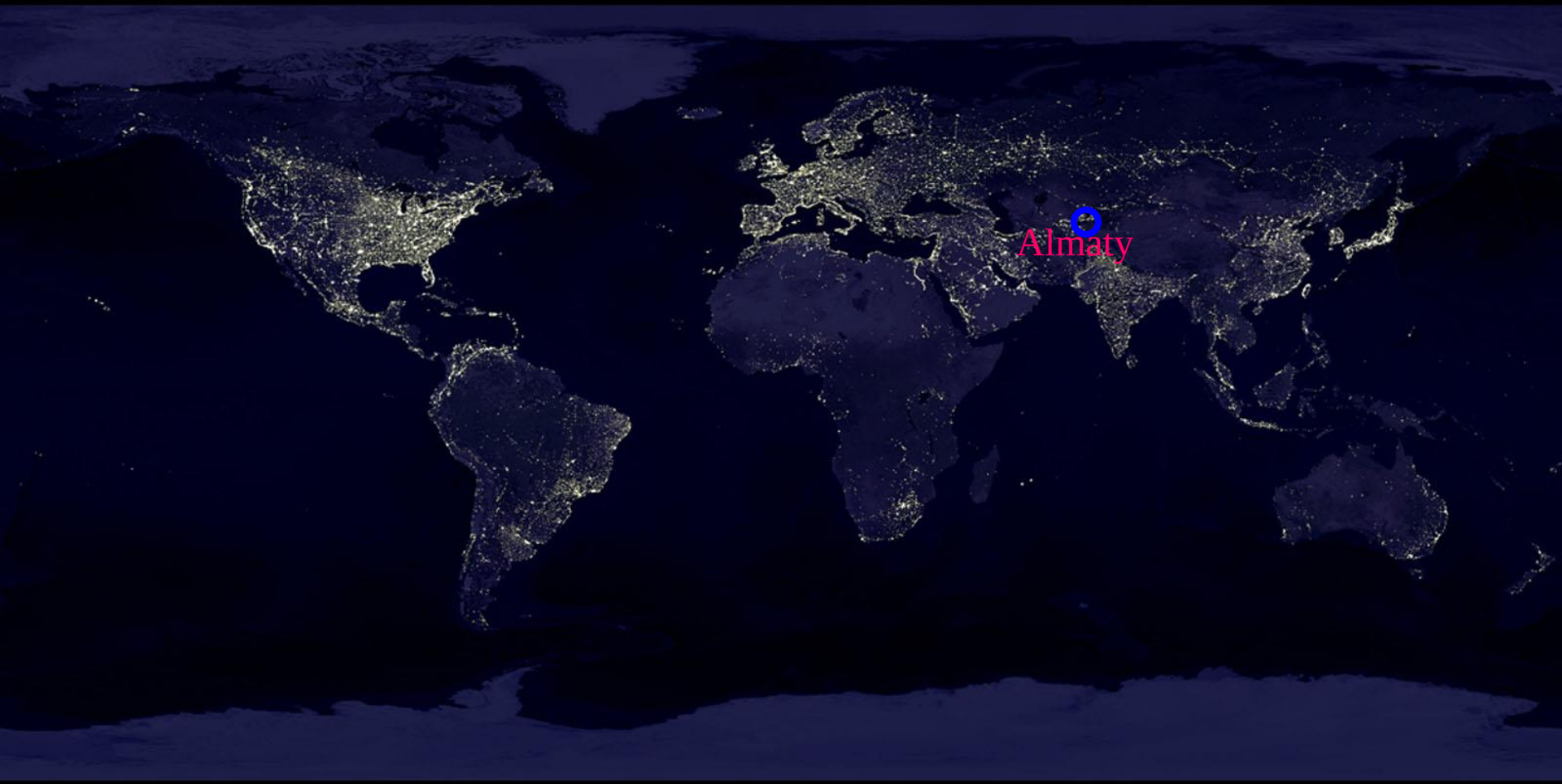
WHERE IT IS

Almaty tonight



Kazakhstan

Night on Earth



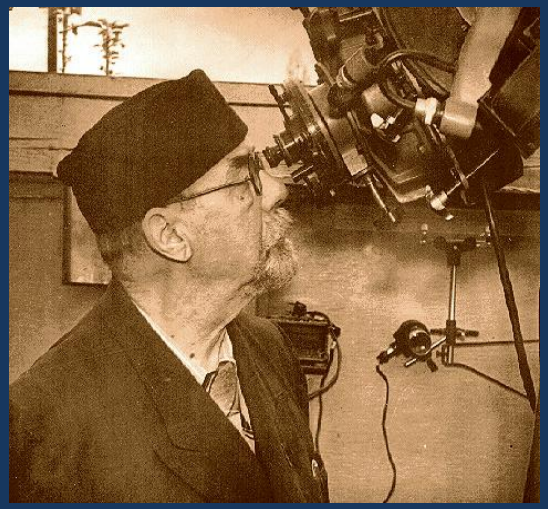
This image of Earth's city lights was created with data from the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS) Originally designed to view clouds by moonlight the OLS is also used to map the locations of permanent lights on the Earth's surface.

Image Credits: Craig Mayhew and Robert Simmon, NASA GSFC based on DMSP data

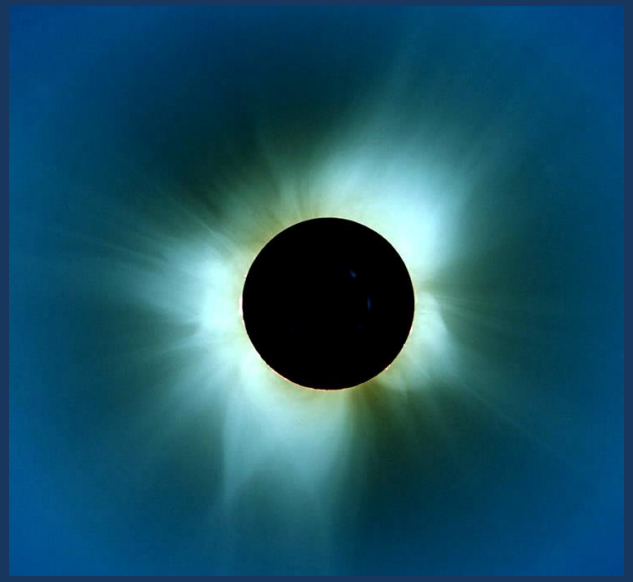
Learn more about the Earth Observing System (http://eos.nasa.gov/)
Learn more about the Earth at the Earth Observatory (http://earthobservatory.nasa.gov/)
Get more Earth images at the Visible Earth (http://visibleearth.nasa.gov/)

FOUNDERS

Prof. Fesenkov V.



Prof. Tikhov G.



research staff

Full solar eclipse in September of 1941 – beginning of the first astronomical research in Kazakhstan

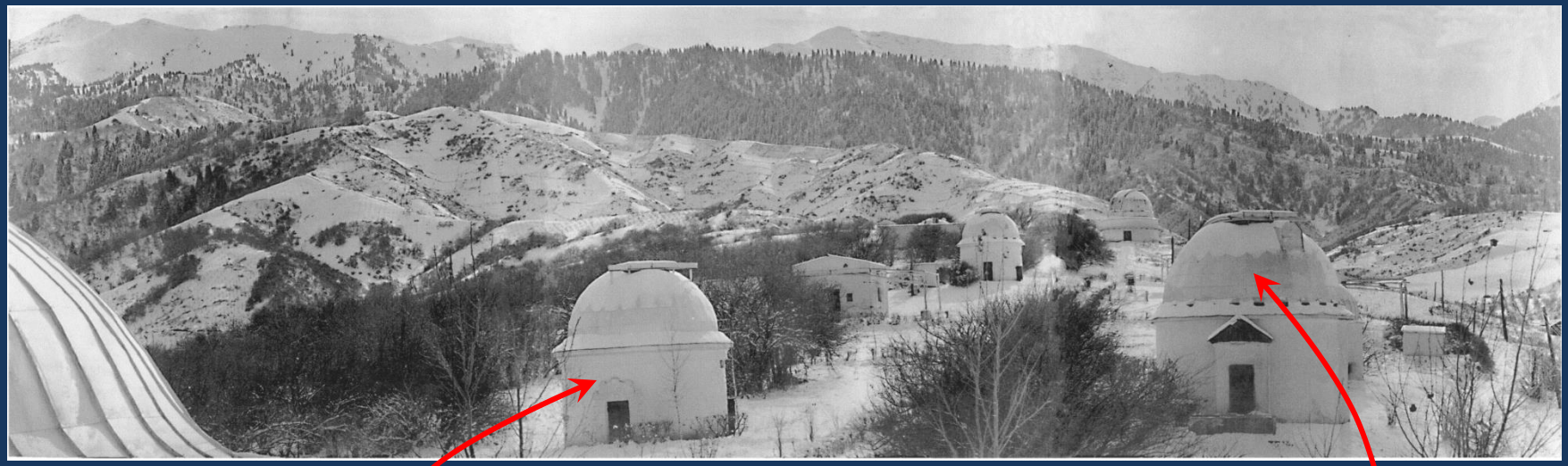
Foundation of Fesenkov Astrophysical Institute

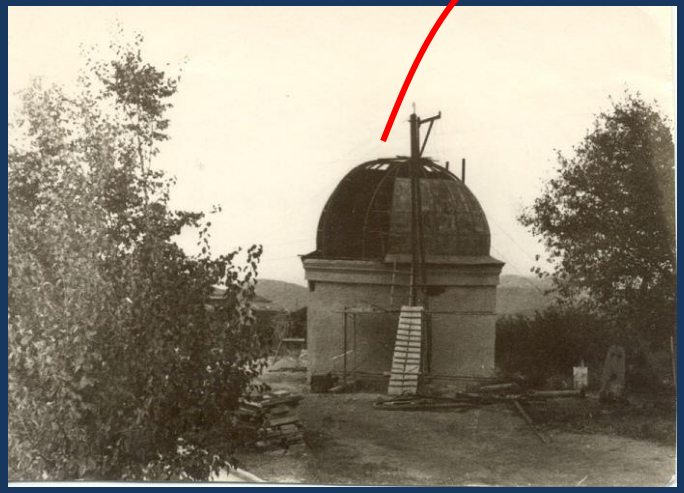
Fesenkov Astrophysical Institute (APHI) is the major scientific organization for fundamental research in astronomy and astrophysics in Kazakhstan. It was founded in 1941 by Vasiliy Grigorievich Fesenkov and since 1989 bears his name.

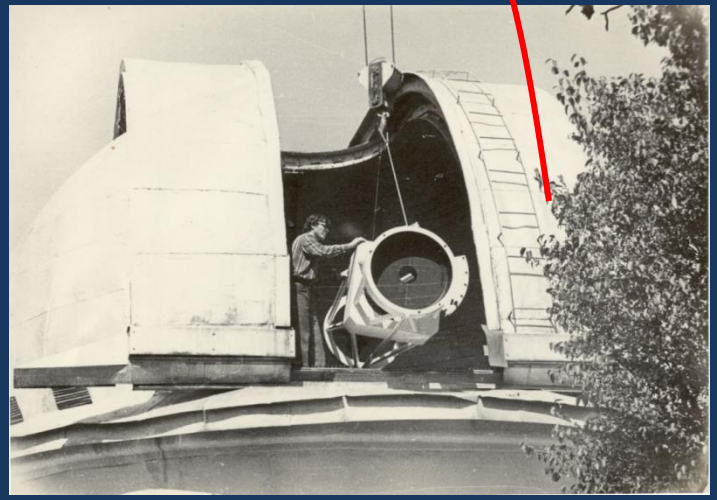
Main building under construction in 1950th

Main building today

Development of Astronomy in Kazakhstan







Observatory at FAI

Astronomical Observatories in Kazakhstan

Observatory at "Kamenskoe Plateau" (1450 м.)

- Clear Night annual 178 (hours 1500)
- Wind speed in clear nights low 1,7 m/sec
- Night median temperature: summer $9,5^0$C
  winter – 10.5^0C
- Horizon opening $3,5^0$

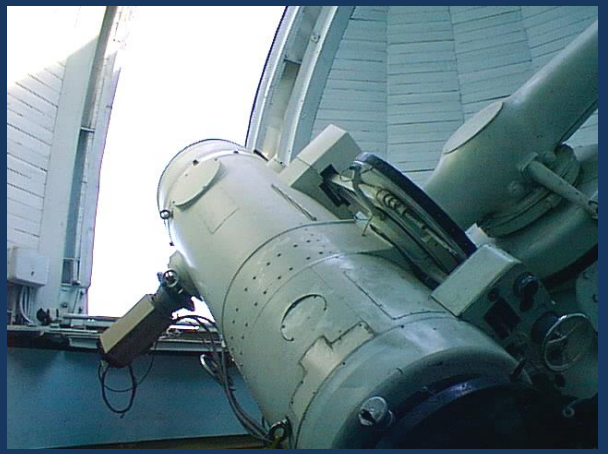
Observatory at Assy-Turgen Plateau (2750 м.)

Observatory at Big Almaty Lake (2840 м.)

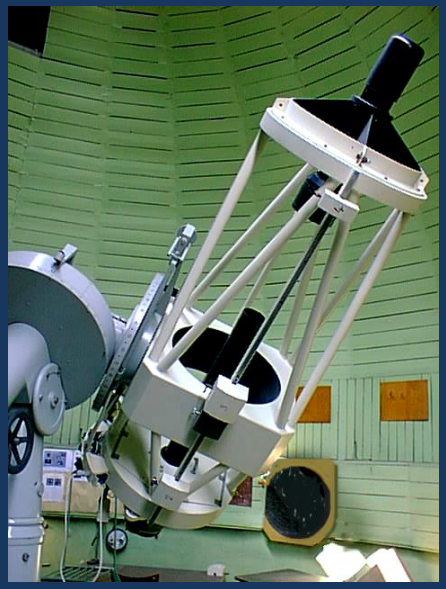
OPTICAL TELESCOPES

0.5-м Herz

0.5-м Maksutov



0.7-м АЗТ-8



0.6-м Zeiss

1-м Zeiss

Subaru, Hawaii

NGC 7635
(Telescop - Zeiss 1000, D=1000 mm F=13350 mm
Almaty, TSHAO, 2013

NGC 7320 (Stephan's Quintet)
(Telescop - Zeiss 1000, D=1000 mm F=13350 mm
Almaty, TSHAO, 2014

NGC 1952
(Telescop - Zeiss 1000, D=1000 mm F=13350 mm
Almaty, TSHAO, 2014

NGC 6946
(Telescop - Zeiss 1000, D=1000 mm F=13350 mm
Almaty, TSHAO, 2014

OBSERVATION AND THEORY

Photometrical and spectral observation of non-stationary objects

Investigation of non-stationary young stellar object

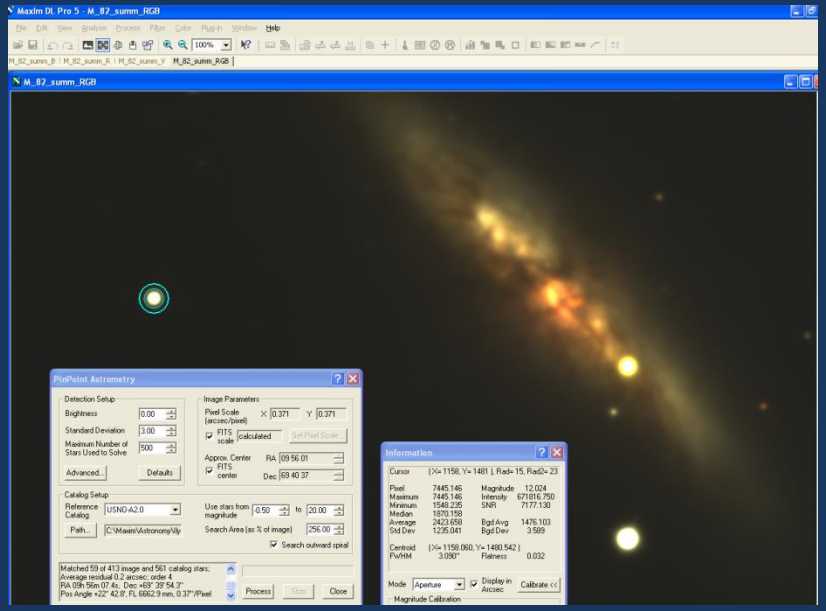
Investigation of the structure and dynamics of gravitating systems in the Universe

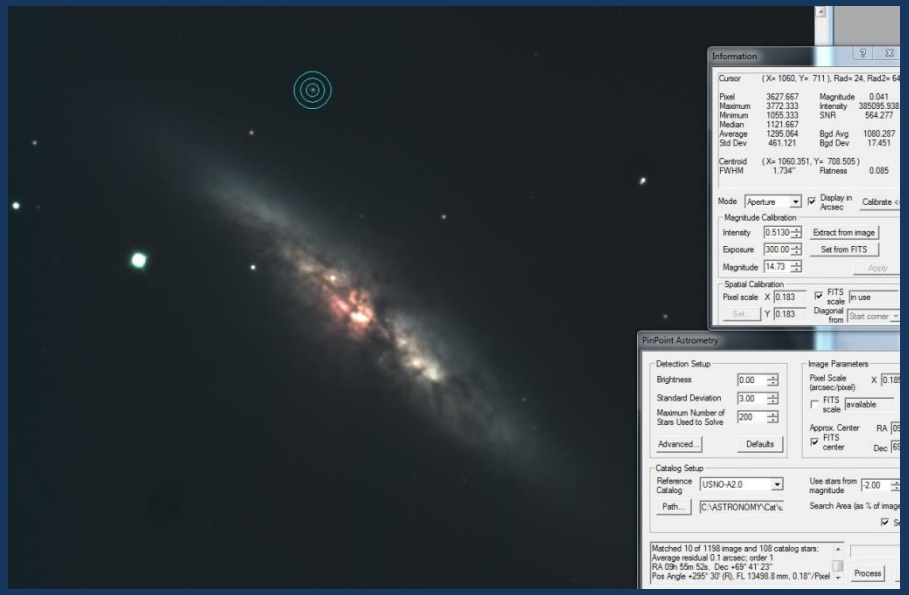
Investigation of star a star with exoplanets

Numerical simulation of the

dynamics of stellar systems

OBSERVATION AND THEORY

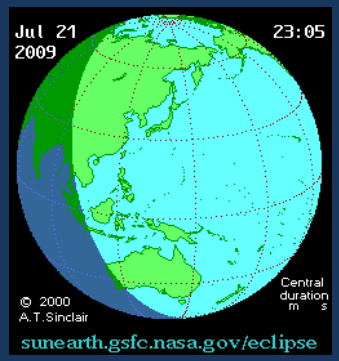


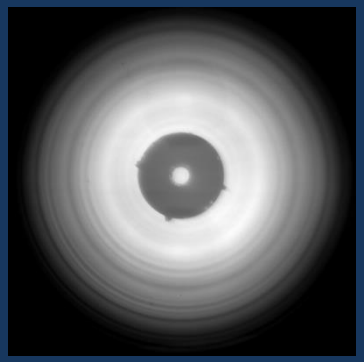


Supernova SN 2014J was discovered in the Observatory London college University on January 21 at the bright galaxy M82 (Cigar Galaxy), which is from us at a distance of about 12 million light-years. A spiral galaxy in the constellation Ursa Major. Processes of star formation take place in it.

OBSERVATION AND THEORY

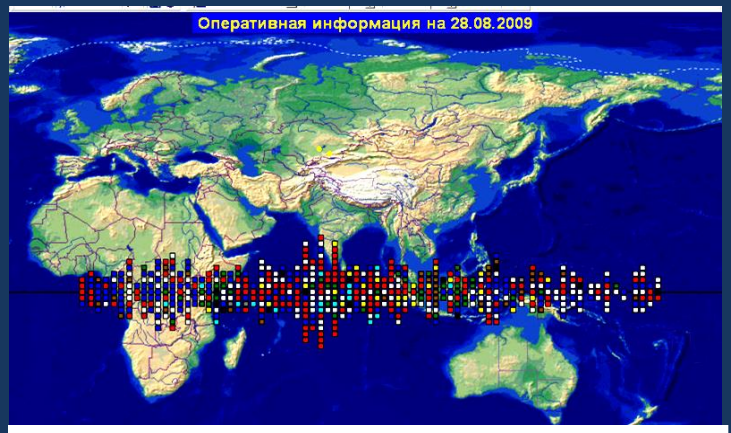
Investigation of optical and dynamical properties of objects of the Solar system



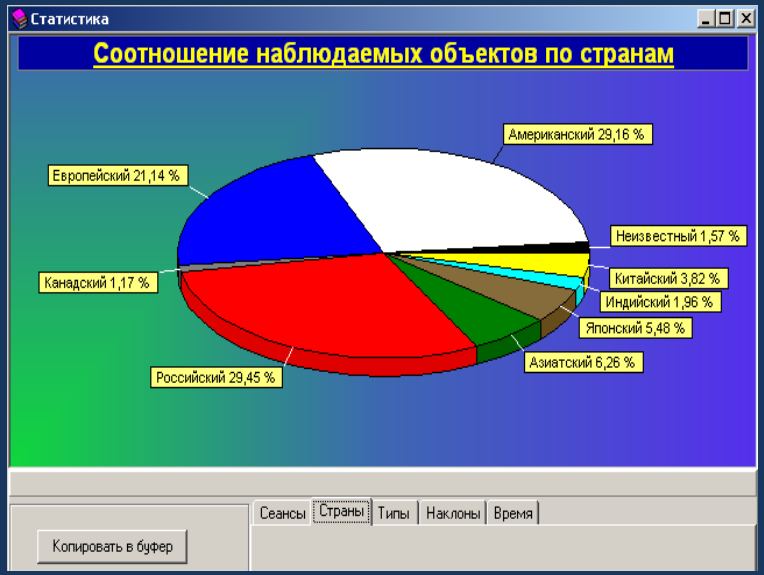


Observation of Geostationary Satelites

- Method of space orientation of GSS is developed

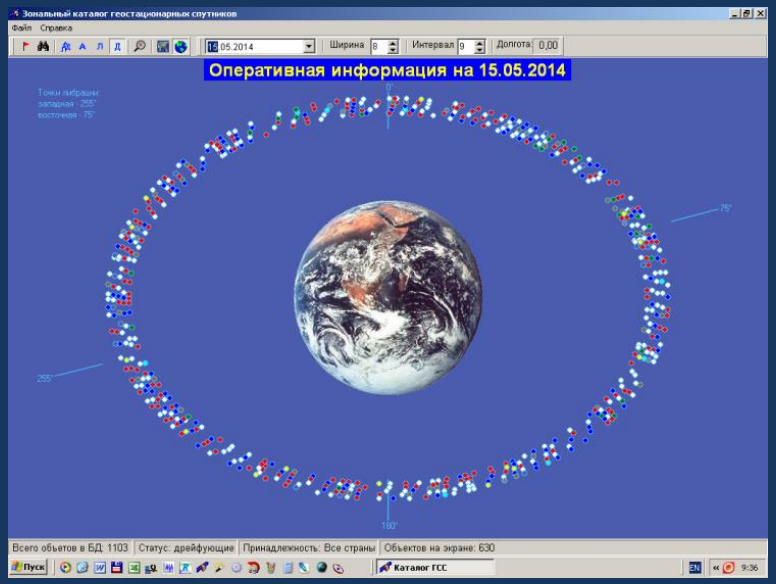


operational information



countries

OBSERVATION AND THEORY

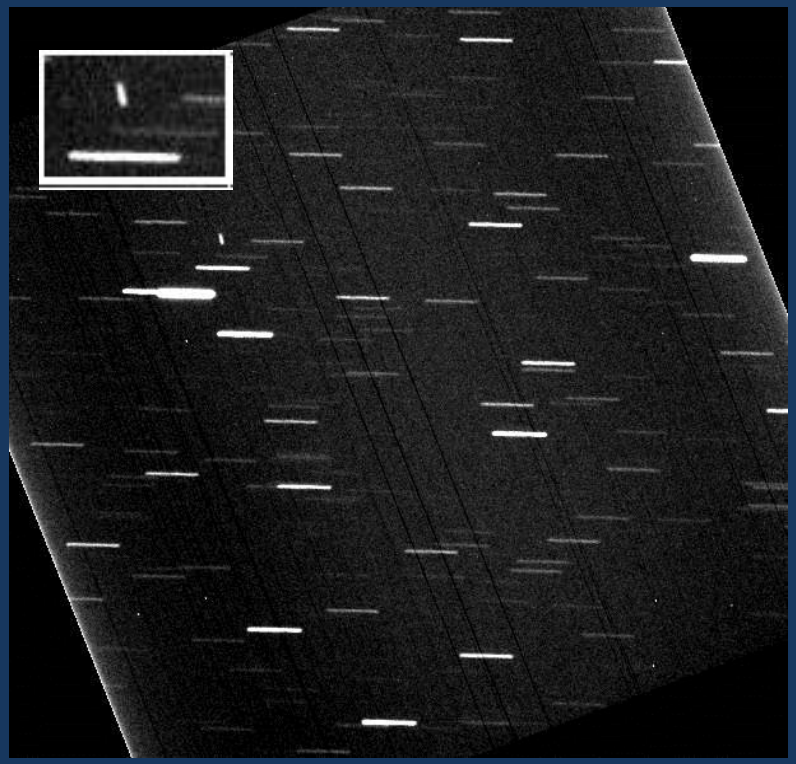


Longitude distribution of geostationary satellites in the monitoring area

Statistics updates the orbital information for the GSS in a controlled area for mid 2014

Surface satelite observations, obtainibg and processing of information – a traditional topics of the Astrophysical Institute from the very beginning of the space age (1957).

CCD-images of GSS



а) with stopped clockwork, object 90008, m ~ 16.4

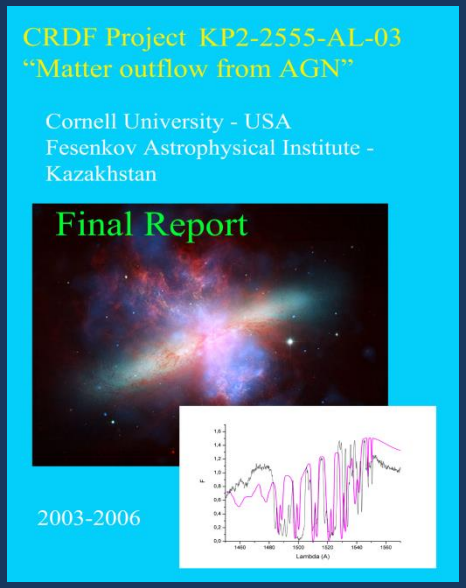
б) Kazzsat-3 (14023B), m ~ 11.8

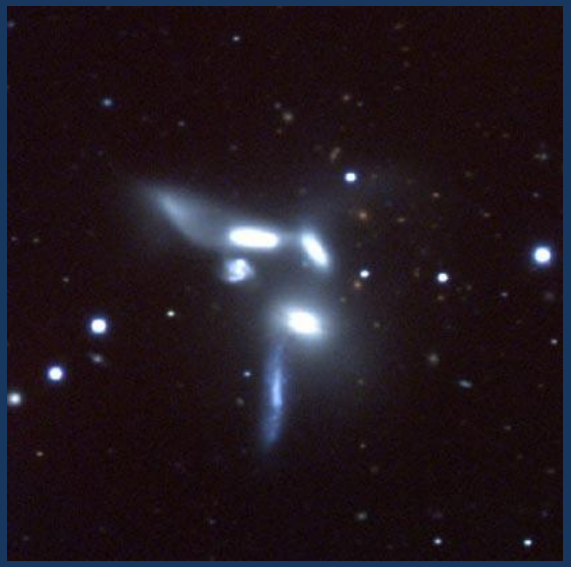
OBSERVATION AND THEORY

Investigation of Seyfert galaxies

from 1958 - observational (spectral) data for over 50 objects permanently updated

Spectrum of 40 Seyfert galaxies were firstly received at FAI.

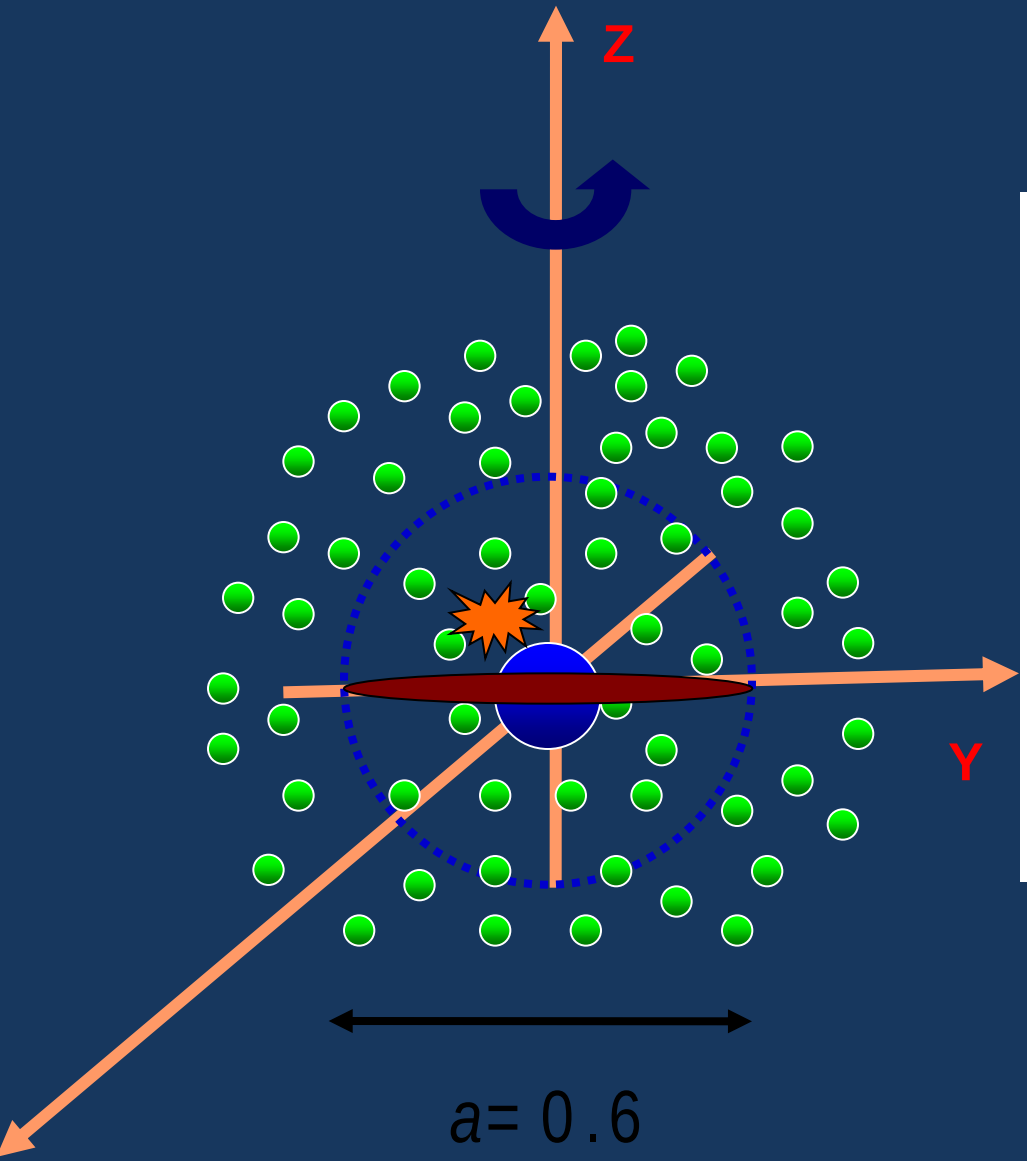




Investigation of Active Galactic Nuclei

Theory and numerical simulations of active galactic nuclei

MODELLING ACTIVE GALACTIC NUCLEI



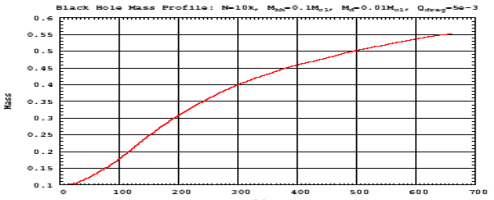


Figure 2: Black Hole mass as a function of time

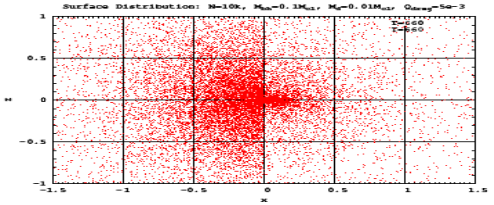


Figure 3: Distribution of stars at the beginning and end of the simulation

MODELLING ACTIVE GALACTIC NUCLEI

Nvidia GeForce CUDA

Andreas Just1, Denis Yurin1,*2*, Maxim Makukov1,2, Peter Berczik1,3,4, Chingis Omarov1,2, Rainer Spurzem1,*3*,*5*, and Emmanuil Y. Vilkoviskij2

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Received 2010 November 29; accepted 2012 August 23; published 2012 September 25

ENHANCED ACCRETION RATES OF STARS ON SUPERMASSIVE BLACK HOLES BY STAR–DISK INTERACTIONS IN GALACTIC NUCLEI

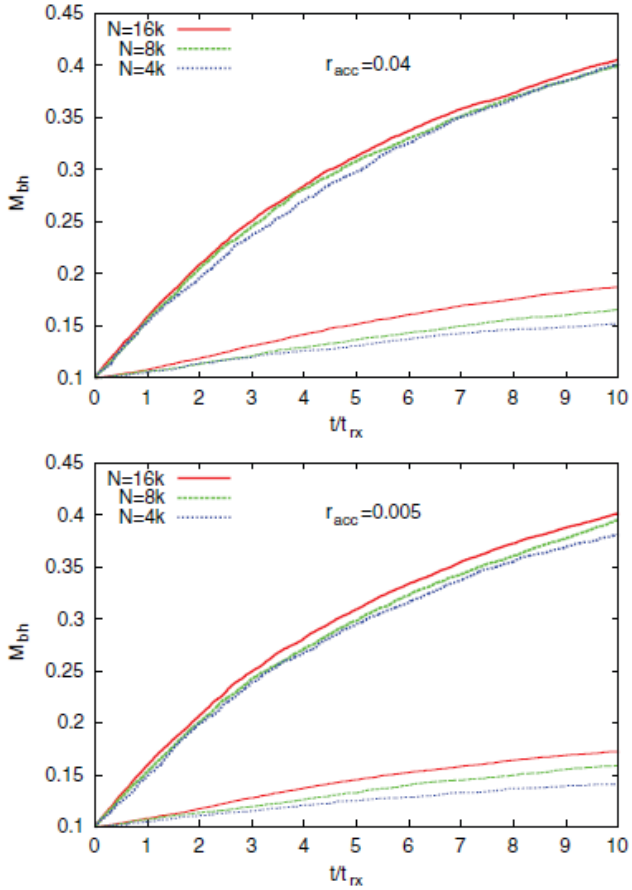


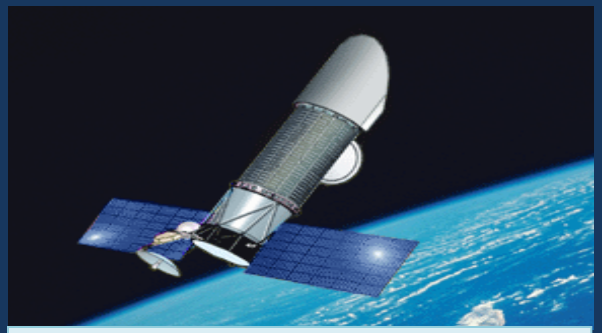
Figure 3. SMBH growth with (upper thick lines) and without (lower thin lines) dissipative force for different accretion radii $r_{acc} = 0.04$ (top panel) and $r_{acc} = 0.005$ (bottom panel). The particle number ranges from $N = 4k...16k$. Q_{tot} scales according to Equation (21) with N.

In Figure (left), the lower set of thin lines show the growing mass of the SMBHfor different particle numbers for the cases without dissipation due to the AD (top panel: *r*acc = 0.04 and bottom panel: *r*acc = 0.005). The accretion rate per relaxation time is seen to slowly increase with particle number. The upper set of thick lines in Figure 3 show that accretion is significantly larger when the dissipative force of the AD is included. The accretion rate is found to be independent of particle number *N*.

ON-GOING AND FUTURE PLANS

Space Astronomy

A major international project "Spectrum-UV" - "World Space Observatory (WSO-UV), World Space Observatory - Ultraviolet) aims to study the universe, out of the reach of observations with ground-based instruments, in the ultraviolet (UV) band of the electromagnetic spectrum: 100-320 nm. The launch is scheduled for 2017



Space Observatory – Specrum-UV

Mirror 1.7m in diametr

Geosynchronous orbit

ON-GOING AND FUTURE PLANS

Спектрограф	Диапазон (нм)	Разрешающая сила
УФЭС	174-310	50000
ВУФЭС	102-172	55000
СДЩ	102-310	2500

Two high-resolution spectrograph - UPES and VUFES (Germany), and the long-slit spectrograph SDSCH (?).

Thanks to new technology of the spectrographs one can work with objects which up to 10 -20 times are weaker than we can do on HST

Telescope T-170M is developed by the NPO Lavochkin

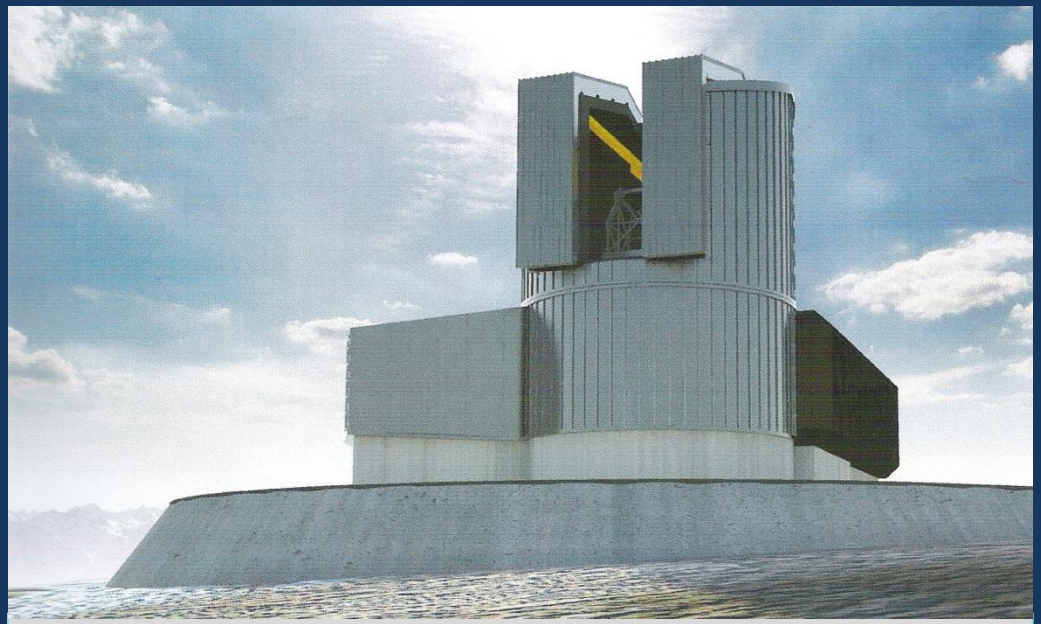
ON-GOING AND FUTURE PLANS

The Earth-based observation astronomy is currently developing in several directions.

- Use of own observatories
- Arrangement of international collaboration
- Use of remote telescopes at international observatories

ON-GOING AND FUTURE PLANS

GROUND-BASED TELESCOPE



3,6 m telescope dome

3,6 m optical telescope will be mounted in Assy Turgen Observatory in 2020

Future Assy observatory

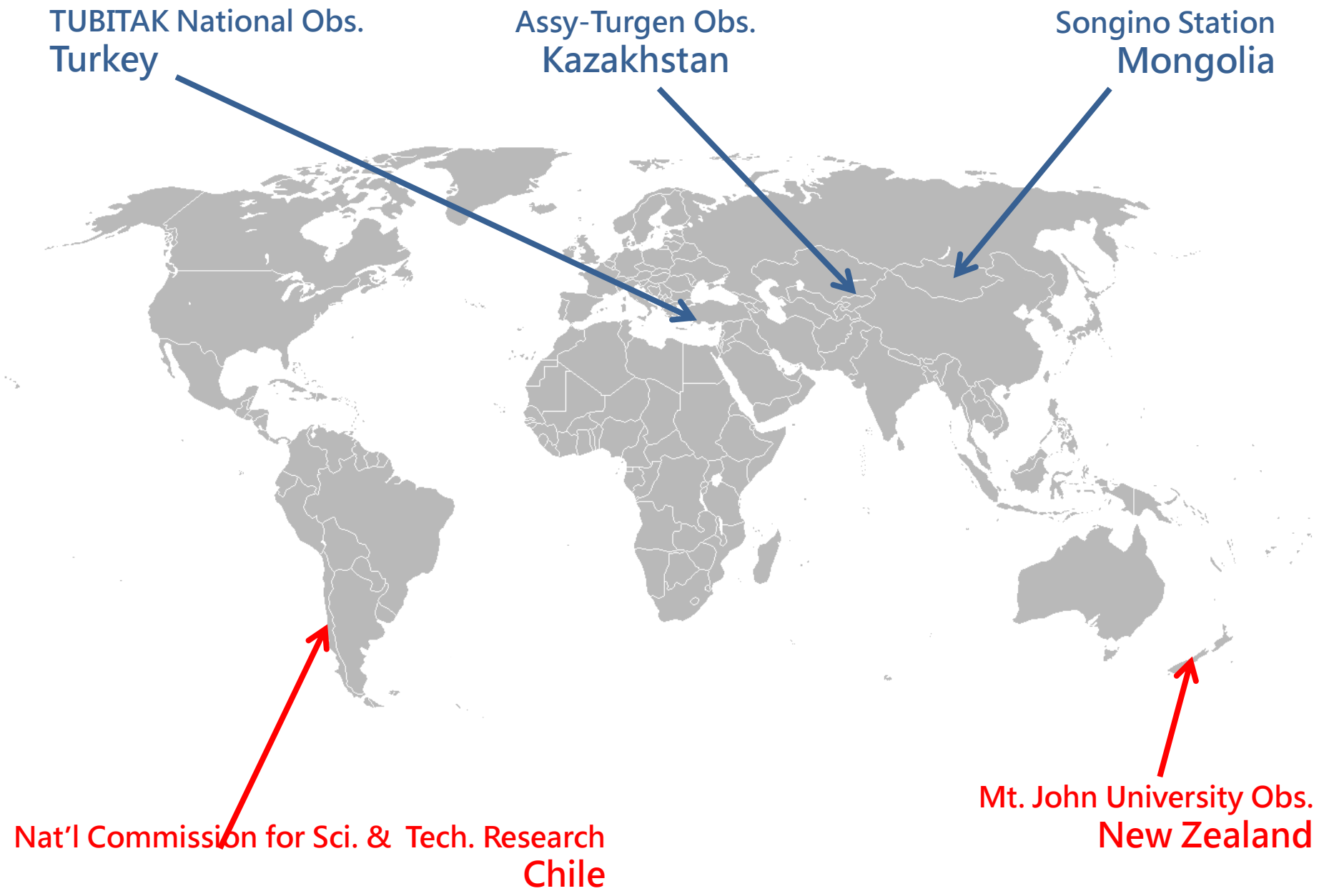
ON-GOING AND FUTURE PLANS

The Optical Wide-filed patroL Network: OWL-Net

Led by: The Korean Astronomical & Space Science Institute

- 6 x 0.5 m wide-field telescopes
- Robotic operations
- **2014-2016**: 3 telescopes + 1 testbed (HQ)
- **2016-2017:** 2 additional telescopes

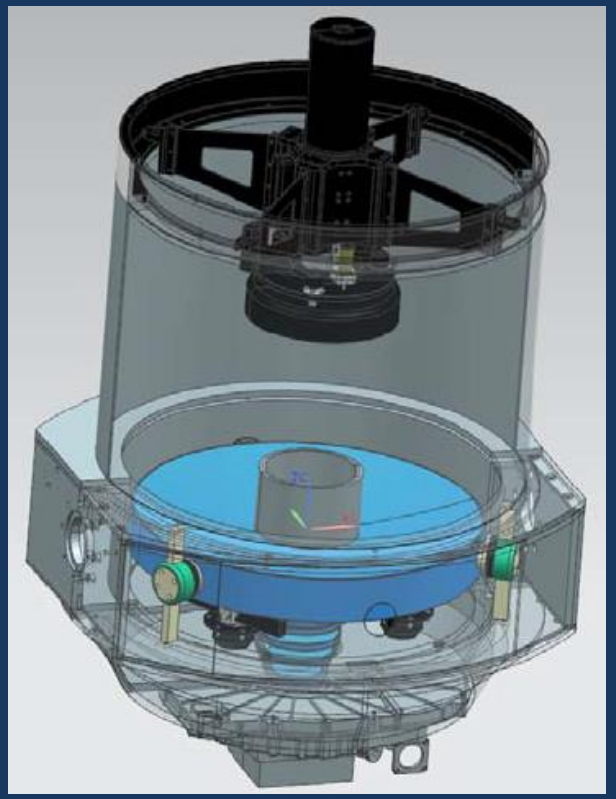
ON-GOING AND FUTURE PLANS



ON-GOING AND FUTURE PLANS

Telescope specification:

Parameter	Value / type
Aperture	0.5 m f/3.8
Optics type	Richey-Cretien
FOV	$1^{o}.1 \times 1^{o}.1$ ($1^{o}.53$, diagonal)
Plate scale	0.98 arcsec/pixel
Mount type	Alt-Az
Speed	10 deg/sec
Acceleration	2 deg/sec^2



ON-GOING AND FUTURE PLANS

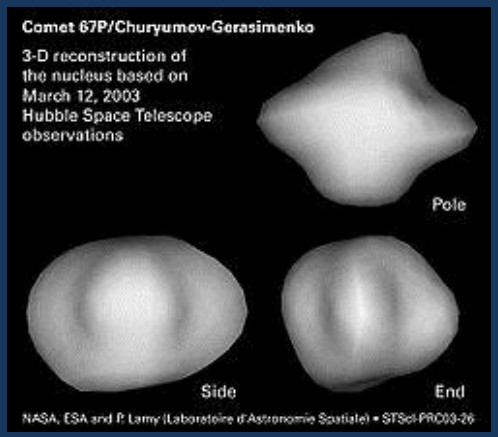
WHAT CAN WE DO WITH OWL?

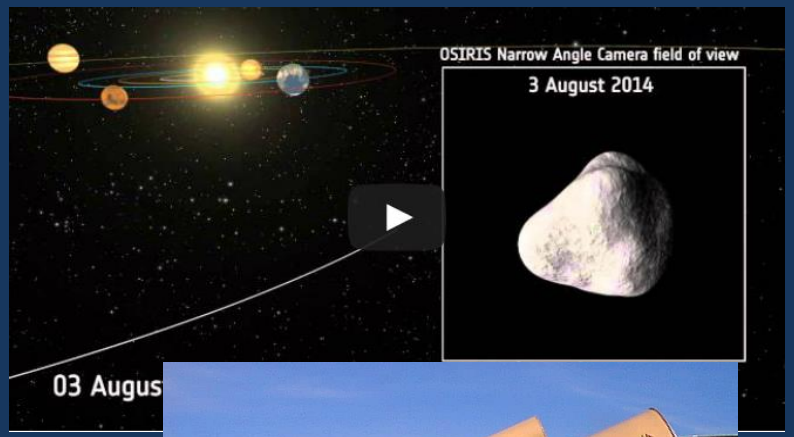
- Multi-band photometry of bright asteroids (NEAs)
  - Spin status and shape model
  - Approximate surface mineralogy
  - Recent collisional history of a family

- Detection and characterization of
  - Earth Satellite Observation
  - Near Earth Comets

Comet 67P / Churyumov-Gerasimenko was discovered 11.09.1969 by means of the meniscus telescope Maksutov of FAI

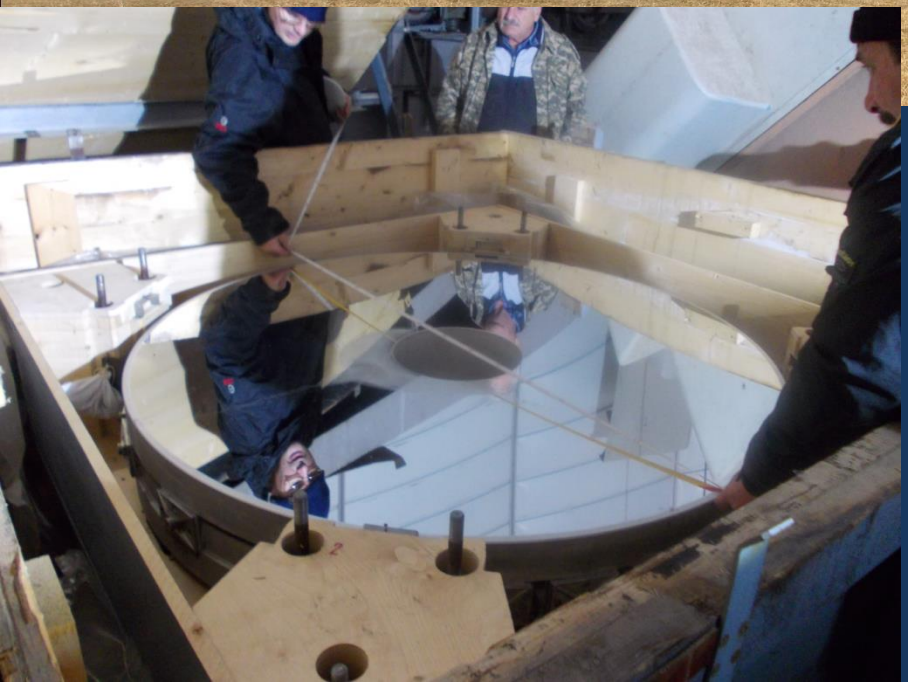
Comet with a period time about 6.6 years, more than 4 km in the diameter. The comet was opened on October 23, 1969 by K. Churyumov on the photographic plates made by S. of Gerasimenko on September 11, 1969 when studying of other comet. It reaches the perihelion at distance of 1,28 AU..





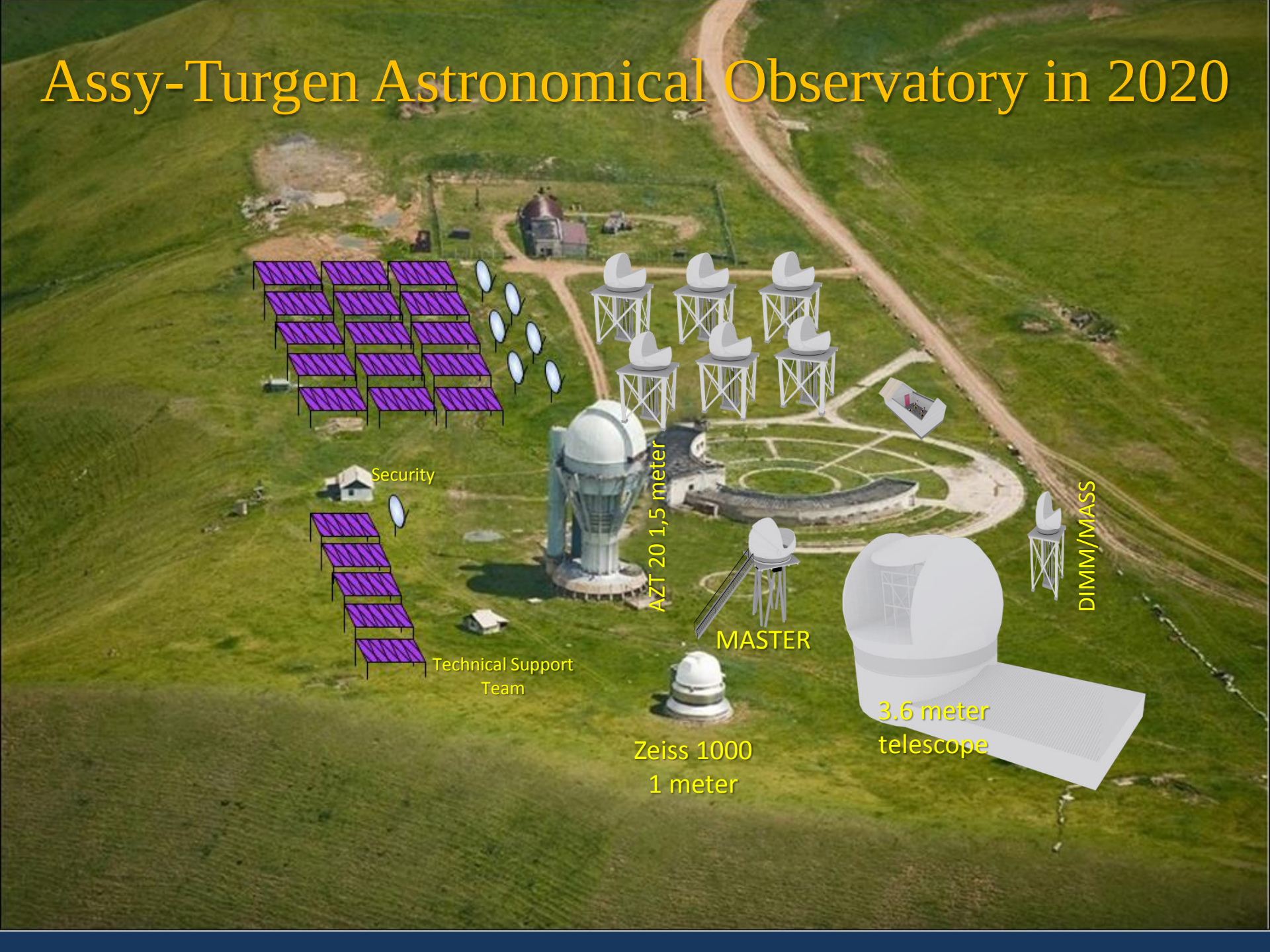
Specacraft Mission of the European space Agency «Rosette», was started on March 2, 2004 and made gravitational maneuver about Mars. Its goal - a meeting with a comet 67P/of Churyumova-Gerasimenko. Philly's module weighs 100 kg. It landtd o the comet kernel this November, 2014.

ON-GOING AND FUTURE PLANS



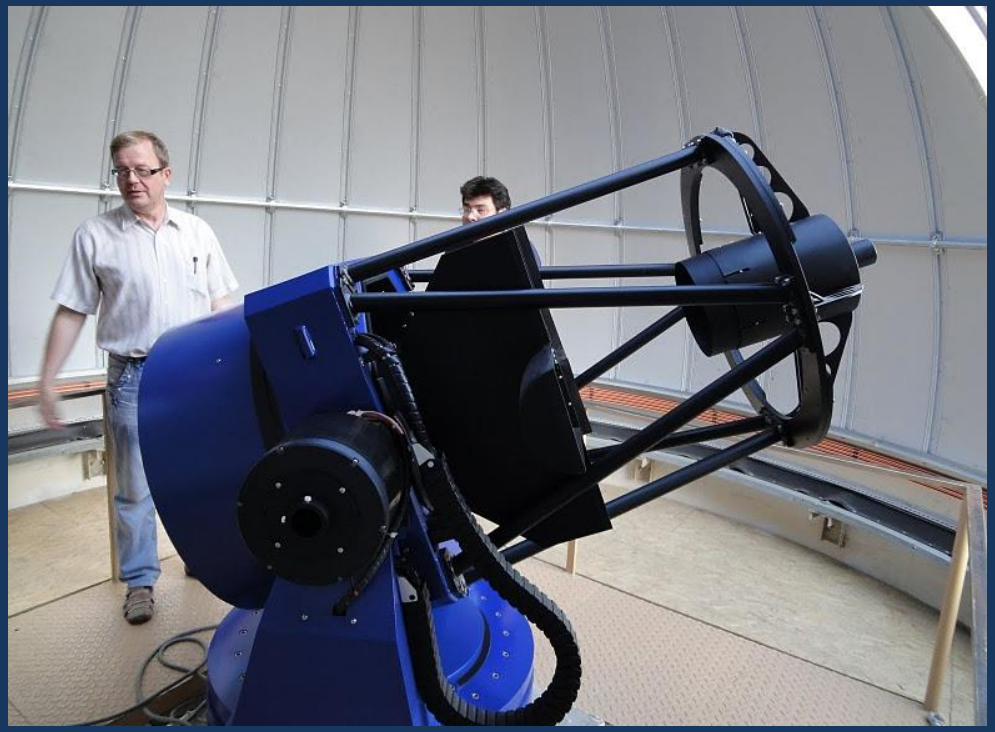
1,5 m – mirror today of perfect quality

Assy-Turgen Astronomical Observatory in 2020



Outreach Activity

Young astronomers in Almaty



0.6 m telescope Karl Zeiss, in Almay High school

RECENT INTERNATIONAL EVENTS

2012 FAI became a full member of IAU (XXVIII General Assembly of IAU)

2013 – FAI hosted International workshop MODEST-13

2015 – Fessenkov readings (October)

Dr. Sekiguchi, Dr. Musabayev (Minister), Dr. Omarov

Participants of MODEST-13

THANK YOU !