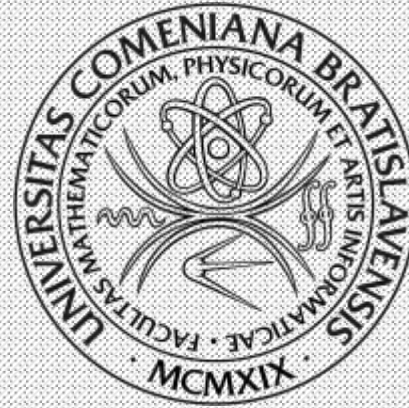
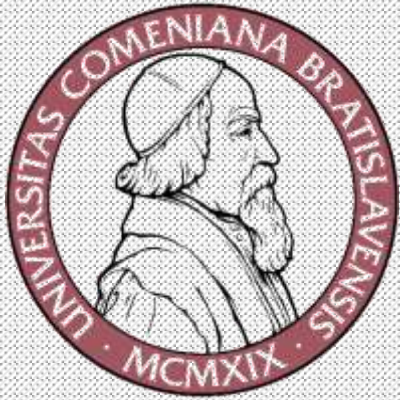




Comenius University

RNDr. Roman Nagy, PhD.

Outline



- the structure of the university
- astronomy at the university
- the fields of research

Comenius University in a nutshell



- the oldest and the largest university in Slovakia
- established in 1919
- wide range of fields - 13 faculties
- approx. 27 000 students

Main Building of the University



Faculty of Mathematics, Physics and Informatics



2013



2019



Astronomy at Comenius University



- Faculty of Mathematics, Physics and Informatics
- Department of Astronomy, Physics of the Earth, and Meteorology
- Division of Astronomy and Astrophysics

AGO Modra



AGO Modra



AGO Modra



Students and colleagues



Students and colleagues



Astronomy at Comenius University



- fields of research:
 - interplanetary matter
 - meteor astronomy
 - galactic astrophysics
 - space debris

Interplanetary matter



- astrometry and photometry of asteroids and comets
- dynamics and physical properties of asteroids (rotation rates, ...)
- theoretical research on non-gravitational effects

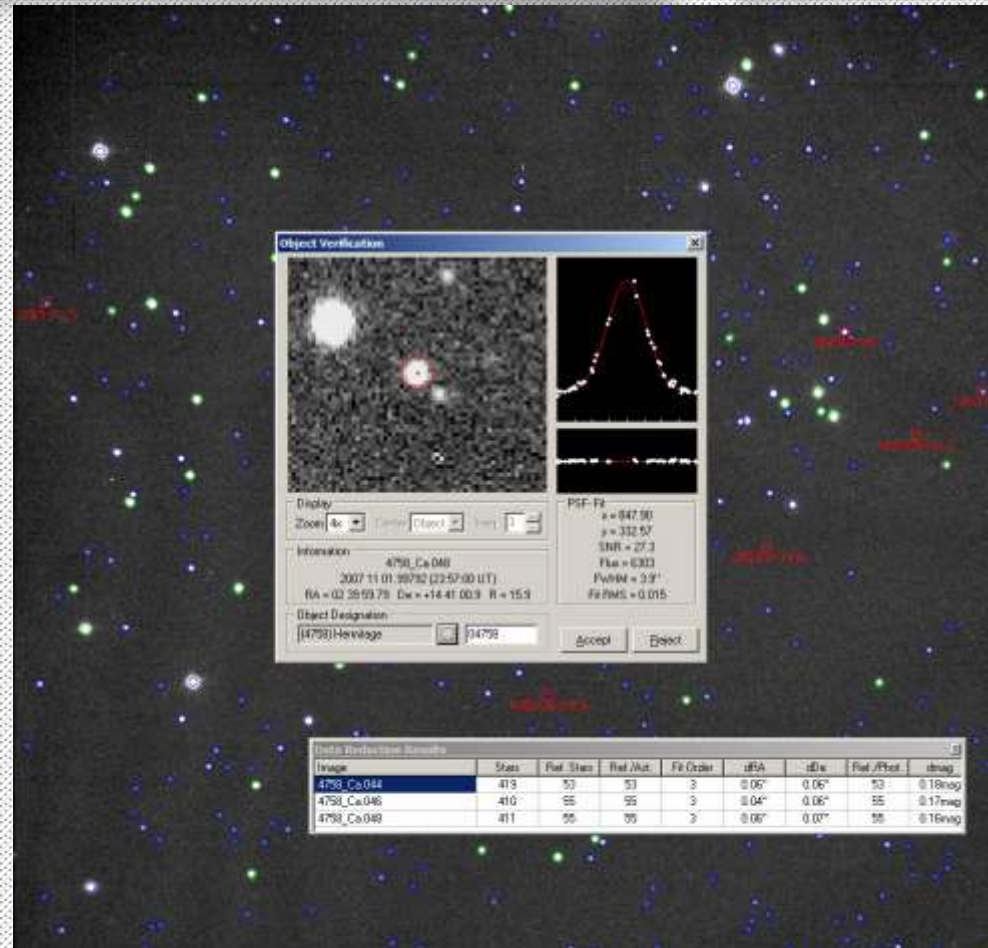
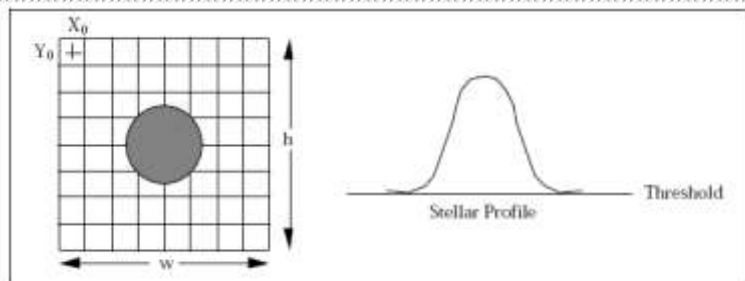
60 cm telescope



Astrometry



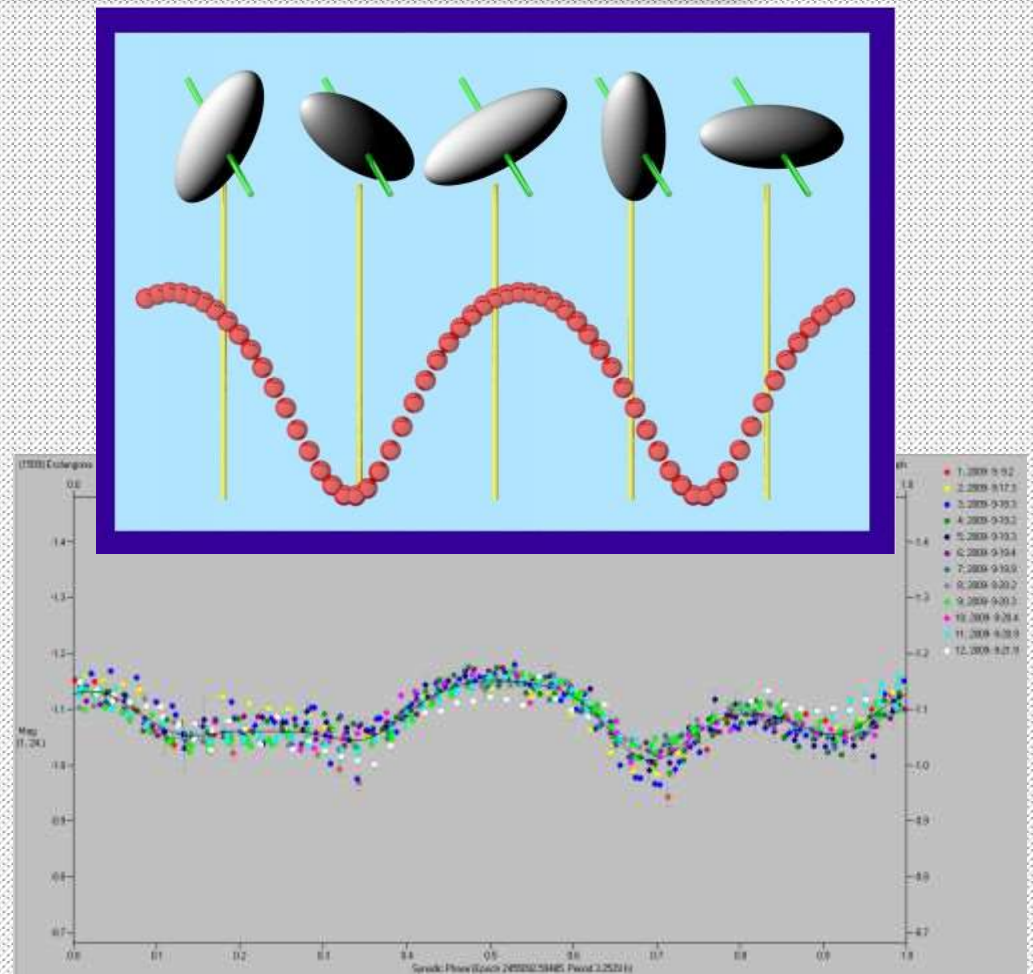
- 20 mag
- 25 x 25 arcmin
- 1.5 "/ px
- NEO
- Comets
- Orbits calculation



Photometry



- 17. mag
- NEO, Mc, MBA
- Rotation period
- Precession



Meteor astronomy



- observations:
 - video
 - radar
 - spectroscopic

Leonid meteor shower in 1998



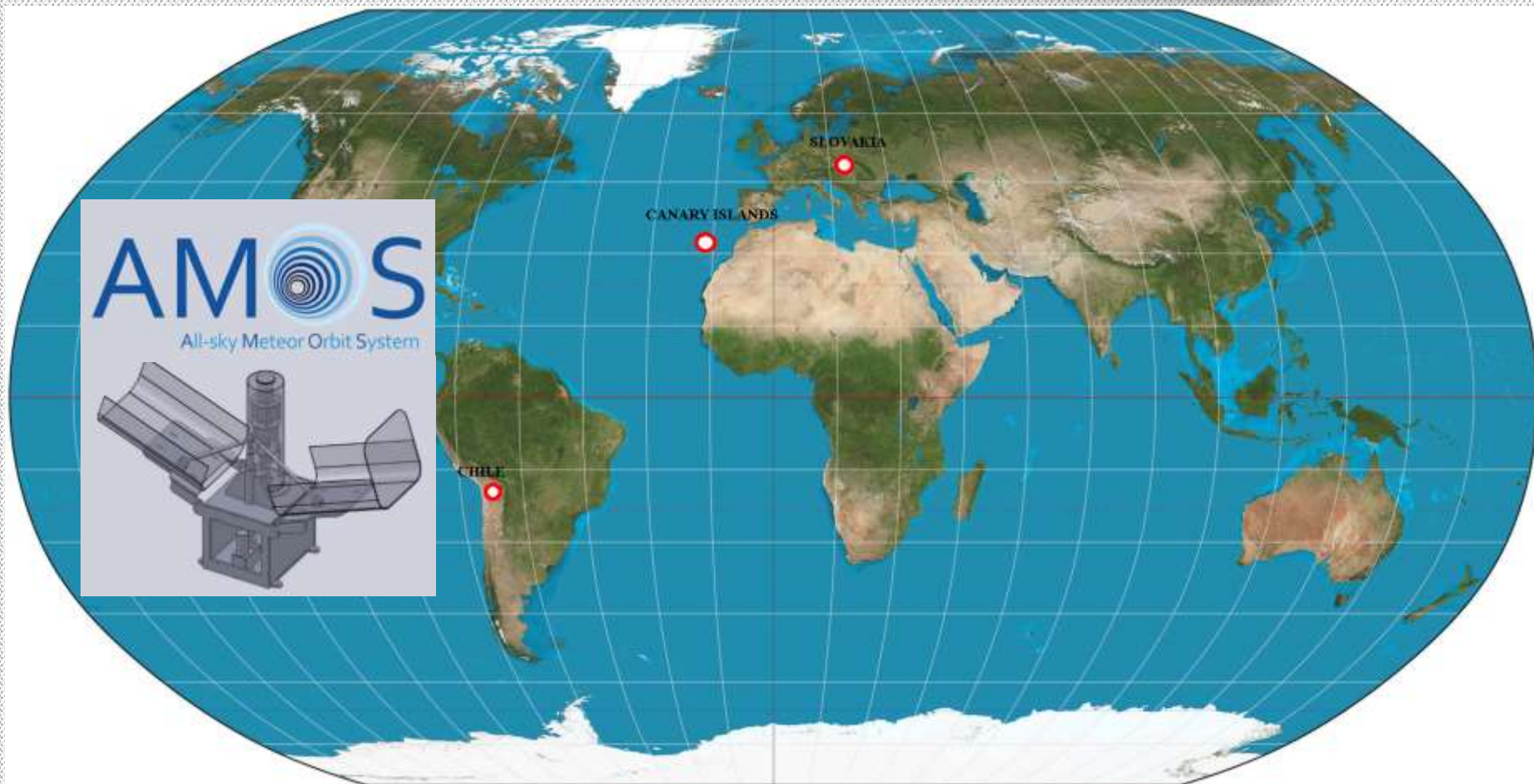
AGO Modra, FMFI UK

Video observations

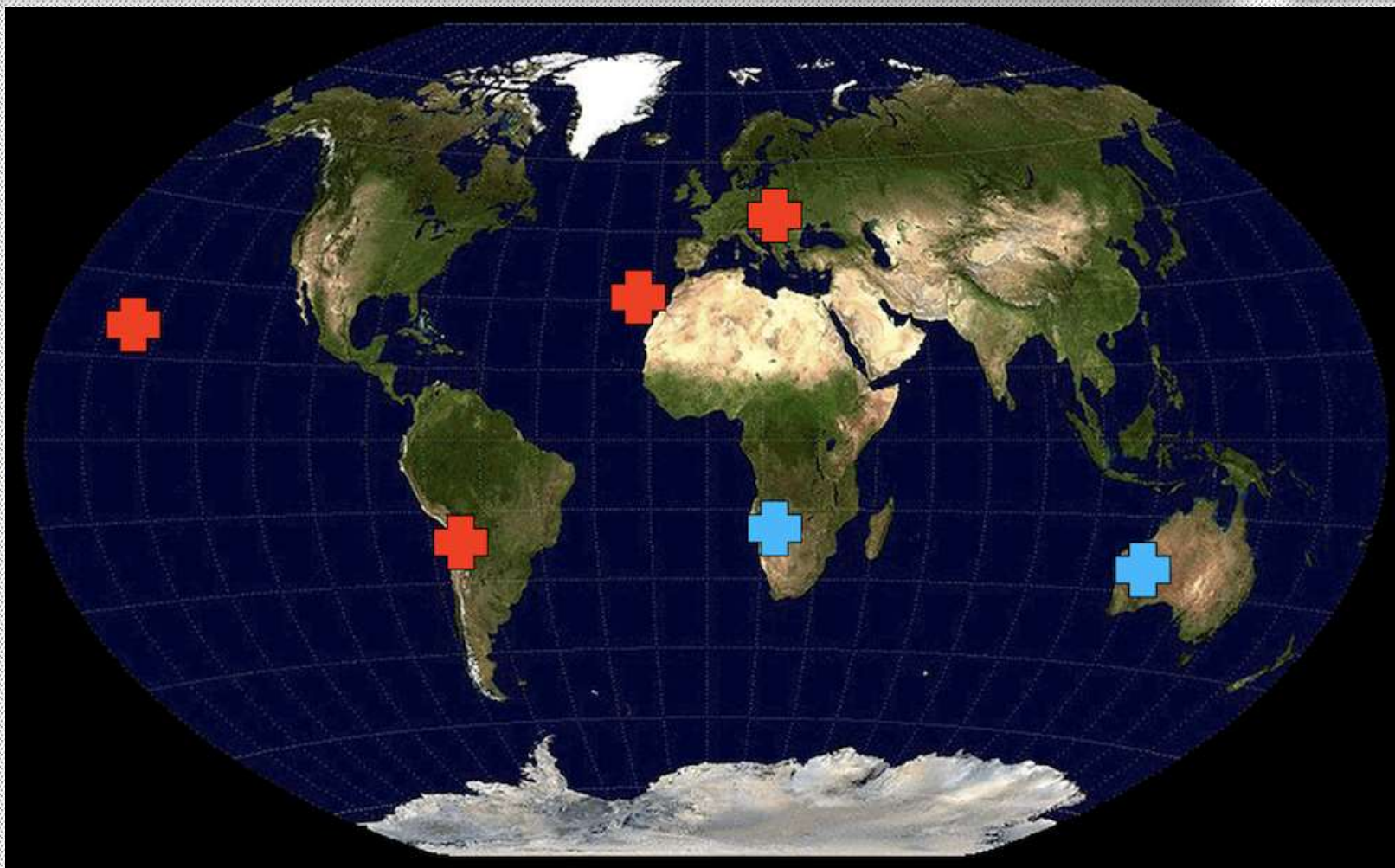


- AMOS - All-sky Meteor Orbit System
- from 2009
- 10 stations (Slovakia, Canary Islands, Chile, Hawaii)

AMOS



AMOS



AMOS - Teide Observatory



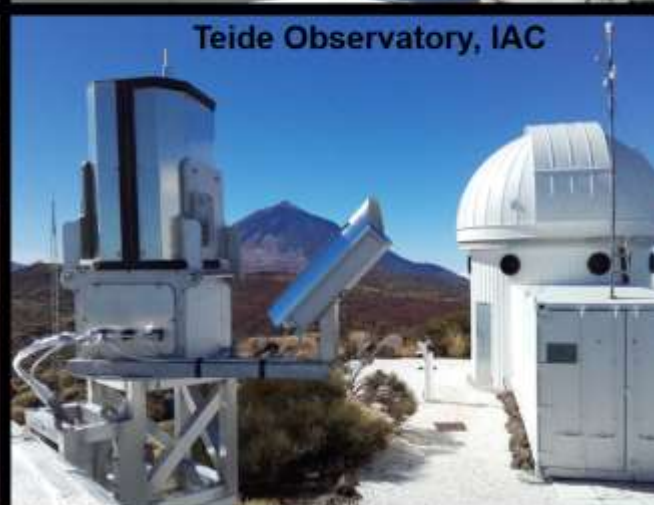
AMOS - Teide Observatory



AMOS - Hawaii



AMOS



One thousand Geminids above Tenerife Dec.13/14, 2017



AMOS, Teide, IAC
Tóth et al., 2017

AMOS Spectral Instrumentation



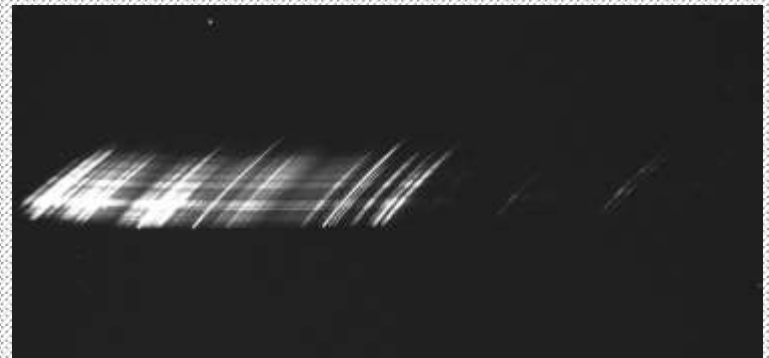
AMOS-Spec

- Camera: 1600x1200, 12 fps
- Grating: 1000 grooves/mm
- Resolution: 1.5 nm/px
- FOV: 100 deg circular
- Lim. mag.: -2.0
- AGO Modra (Slovakia) - since 11/2013
- Supplemented by 5 AMOS stations (Slovak Video Meteor Network)



AMOS-HS

- Camera: 2048x1536, 15 fps
- Grating: 1000 grooves/mm
- Resolution: 0.5 nm/px
- FOV: 60 x 45 deg
- Lim. mag.: -1.5
- Canary Islands and Chile - since 12/2016
- Hawaii - since 09/2019
- Supplemented by 2 AMOS stations on Canary Islands, Chile and Hawaii



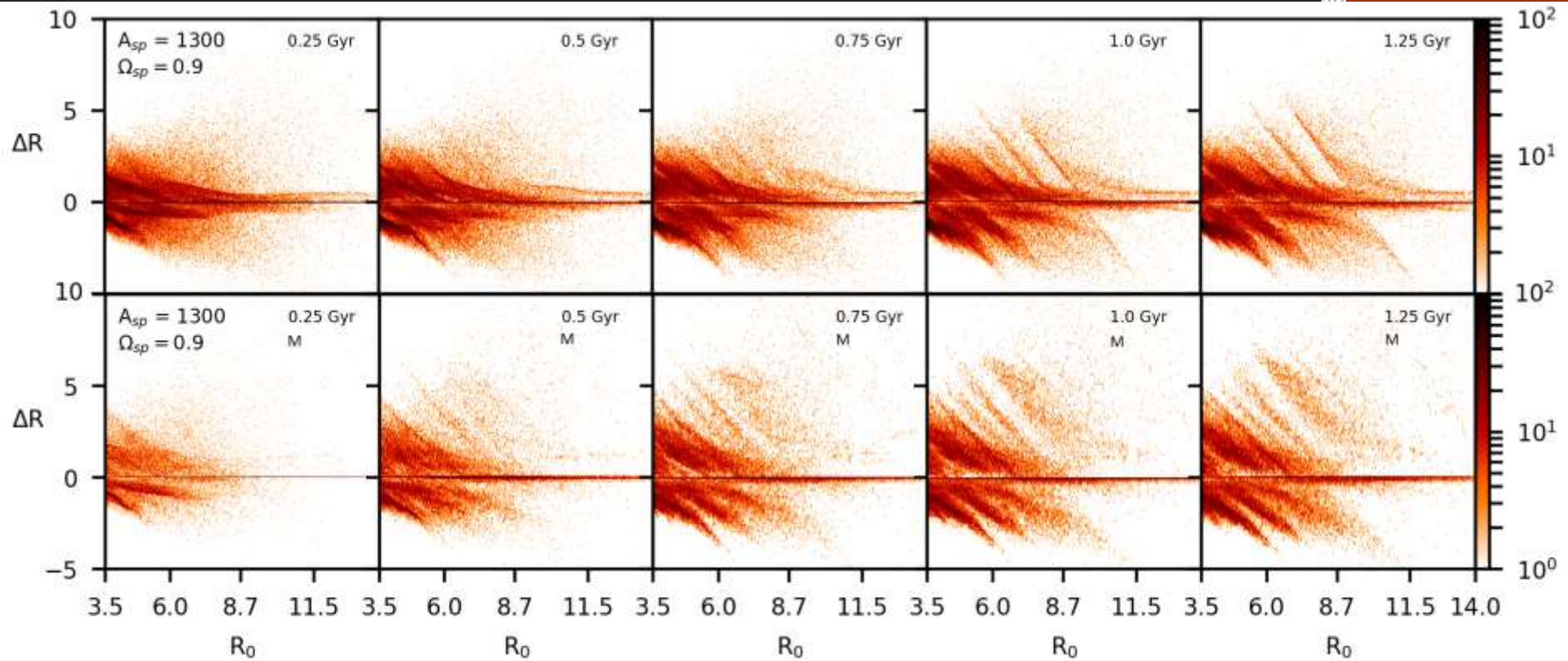


Galactic astrophysics

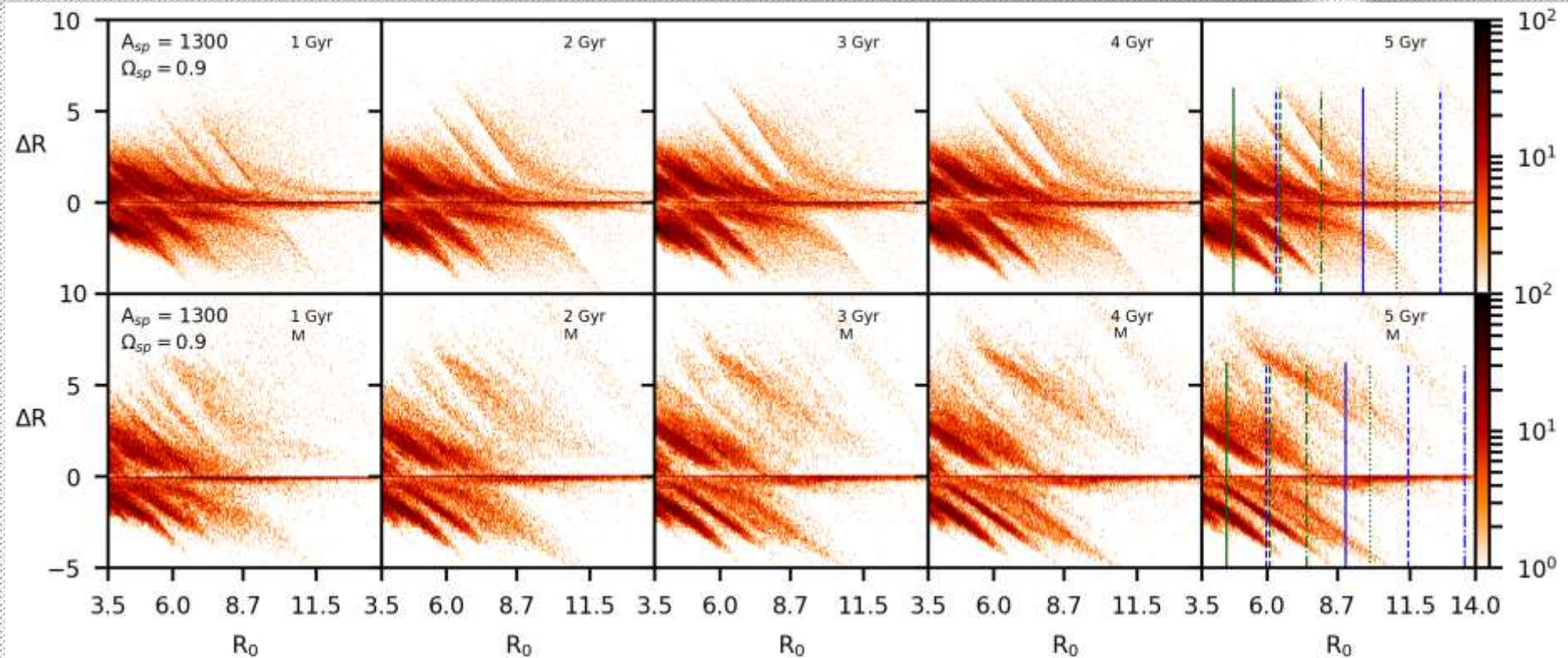


- kinematics and dynamics of the Galaxy:
 - GAIA - galactic flare
 - GAIA - galactic warp
 - SIM - comparison of MOND and NEWTON theories of gravity
- effects of galactic slaps on the Solar System
- theory of gravity

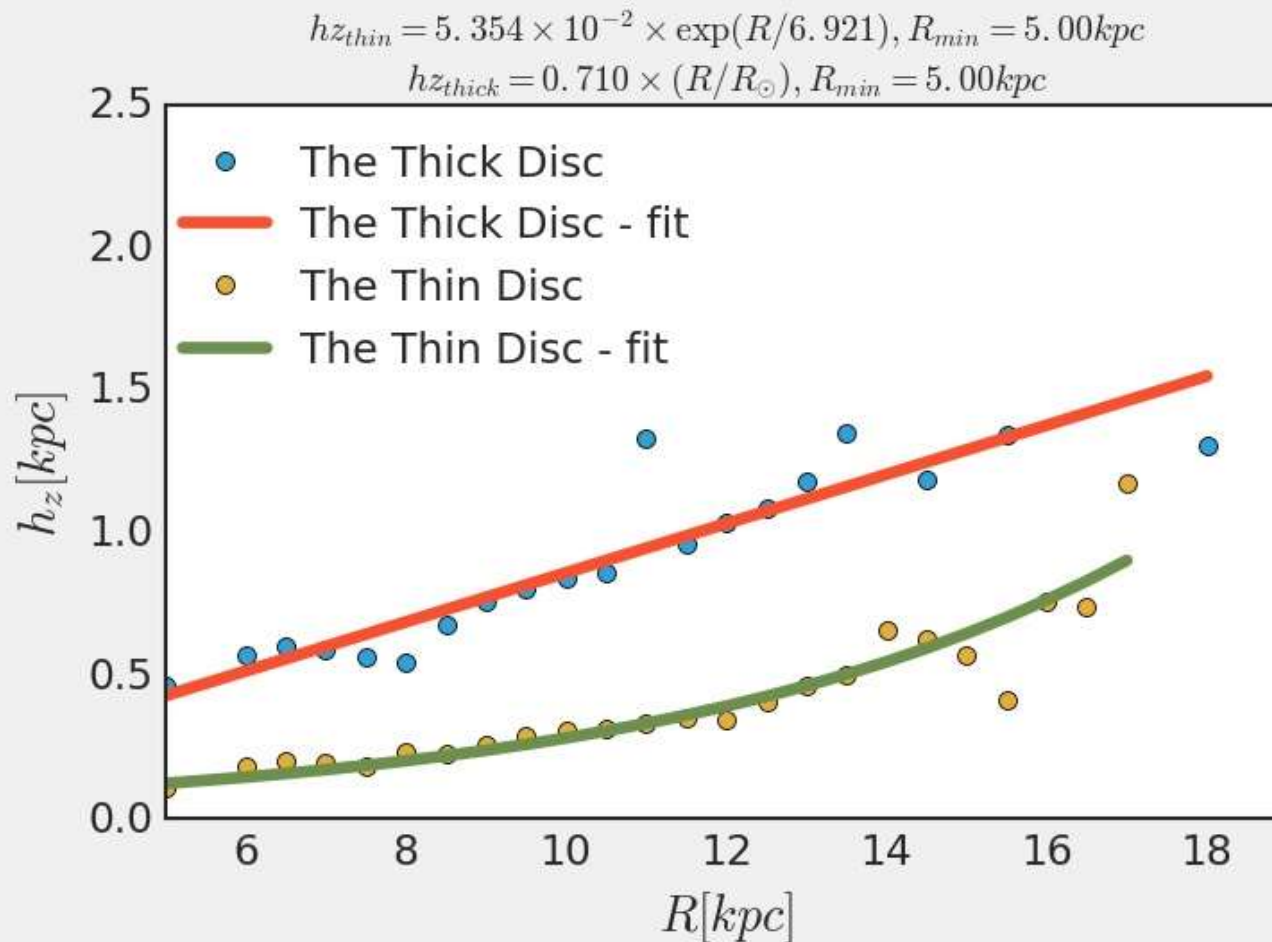
The time evolution



The time evolution



GAIA - The Galactic flare

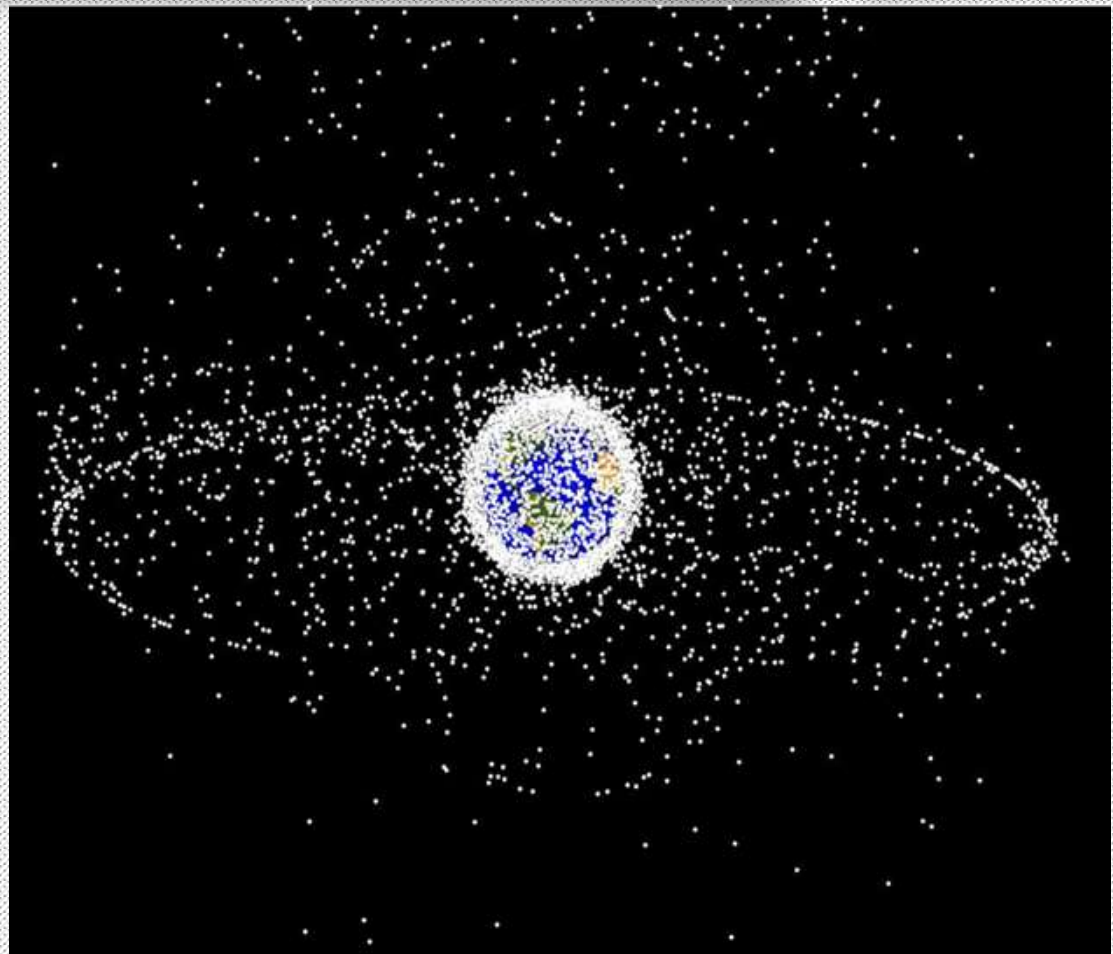


Space debris



- astrometric and photometric observations
- HAMR (High-Area-to-Mass-Ratio) objects
- telescope with 70 cm main mirror - commissioning

70 cm telescope - space debris



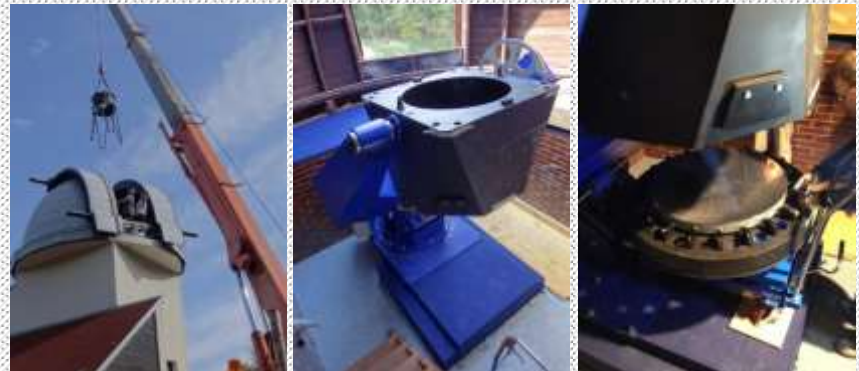
FMPI/AGO's 70cm telescope



- Perform tracking to space debris in order to support European space debris cataloguing, physical characteristics of debris
- Former *ESA PECS HAMROptSen* dedicated to the main objective, cooperation CU (SK, prime) + AIUB (CH)
- Currently *ESA PECS ImpEuroLEOTrack*, cooperation CU (SK, prime) + AIUB (CH) + IWF (AUT)
- Activities cover all aspects - low-level control, planning S/W improvement, observation planning, data acquisition, data processing, image processing SW improvement, tracklet building, object identification, orbit improvement, cataloguing, data format conversion, etc.



Telescope design	Newton
Mount	Equatorial (Open fork)
Camera	CCD
Dimension	1024 x 1024
Primary mirror diameter [m]	0.7
Focal length [mm]; focal ratio	2962.0; f/4.2
FOV [arc-min]	28.5 x 28.5
iFOV [arc-sec/pix]	1.67



AGO70 telescope



Astrometry

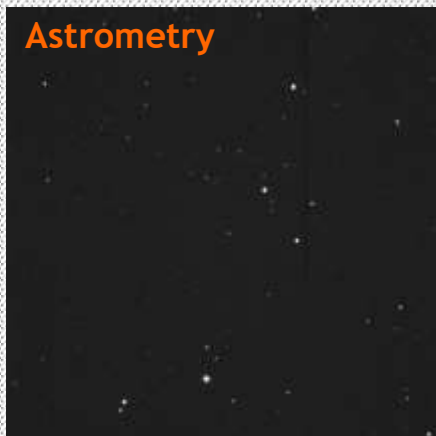


Fig. - Images acquired by AGO 70cm telescope. Astrometric observations of satellite IRNSS-1A (13034A). Other four GEO satellites crossing the FOV. Used exposure time of 0.2 s.

Light curves

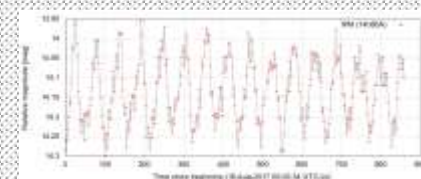
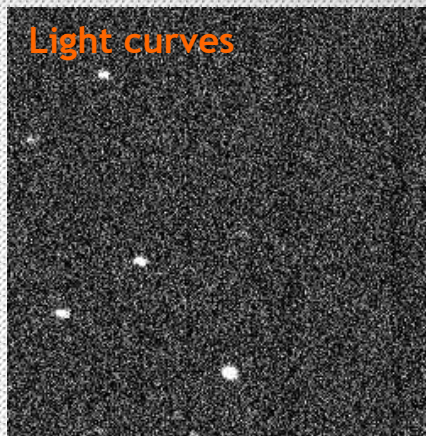


Fig. - Object Dummy IPM (14085A) acquired by the AGO 70cm telescope (left) and the its constructed light curve (right).

BVRI photometry



Fig. - BVR images acquired by AGO 70cm telescope. Color photometry observations of satellite THOR 7 (15022AA). Used exposure time of 5.0 s.

LEO tracking support



Fig. - SL-12 R/B(2) (02037D) observed by AGO 70cm. Compilation of 9 frames, exp = 0.1s, filter I.

AG070 - observation programs - astrometry, time precision

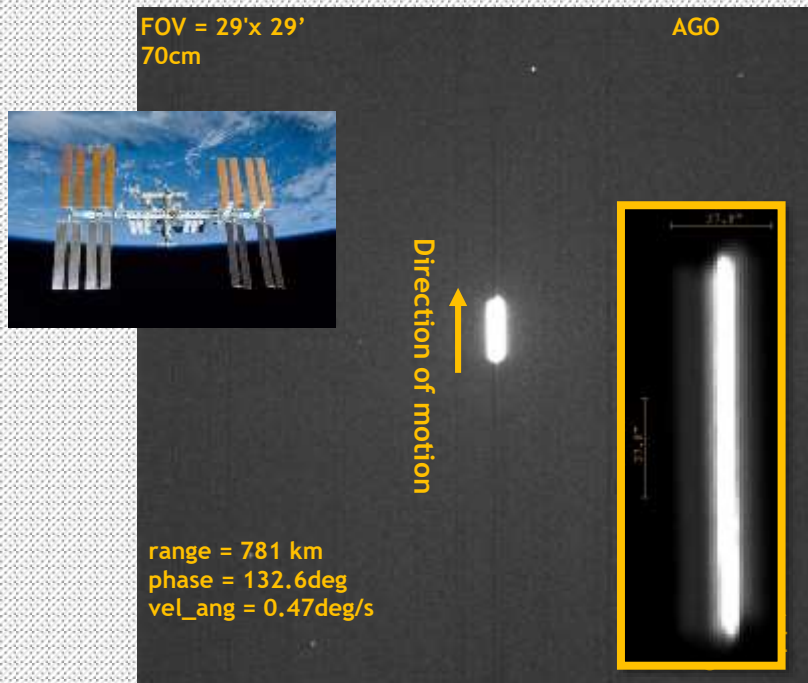


Figure - International Space Station ISS (98067A) acquired by the AGO 70cm telescope. Field RA=07:42:50 and DEC=+46:17:47.6 observed at 2018-05-28T20:40:30.0 with V filter, exp = 0.05s and sidereal tracking ON.

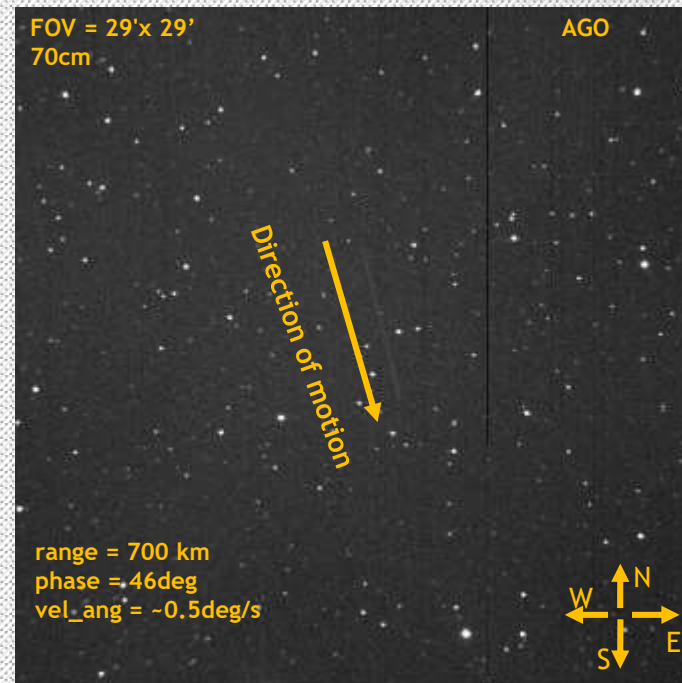


Figure - LEO cubesat SKCube (17036AA) acquired by the AGO 70cm telescope. Field RA=18:0:22.21 and DEC=+02:40:49.3 observed at 2017-08-01T19:49:00 with 'Clear' filter, exp = 0.2s and sidereal tracking ON.



AG070 - observation programs - instrumental photometry



- 1974-039C - TITAN 3C TRANSTAGE R/B

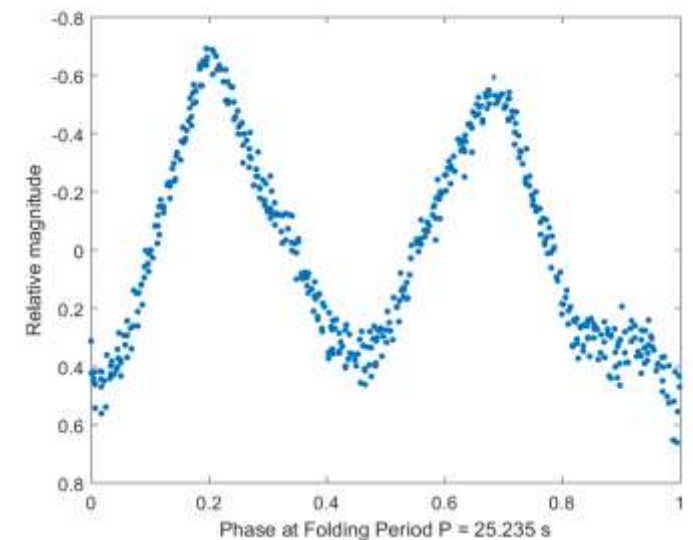
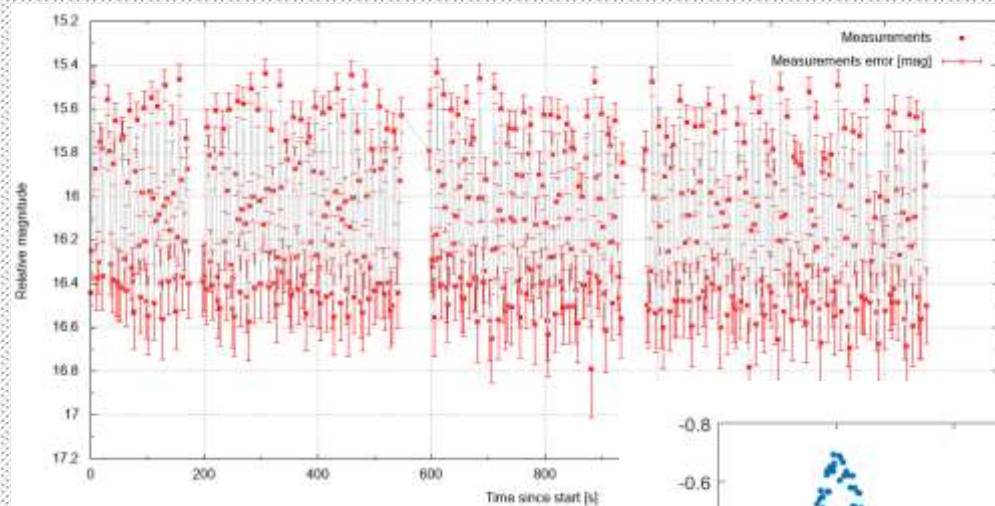


Figure - Photometric measurements acquired by AGO 70cm telescope during night 20181016 (left) and the constructed light curve (middle) and its phase diagram (right) for the object Titan 3C Transtage R/B (74039C).

Optical observations, color photometry

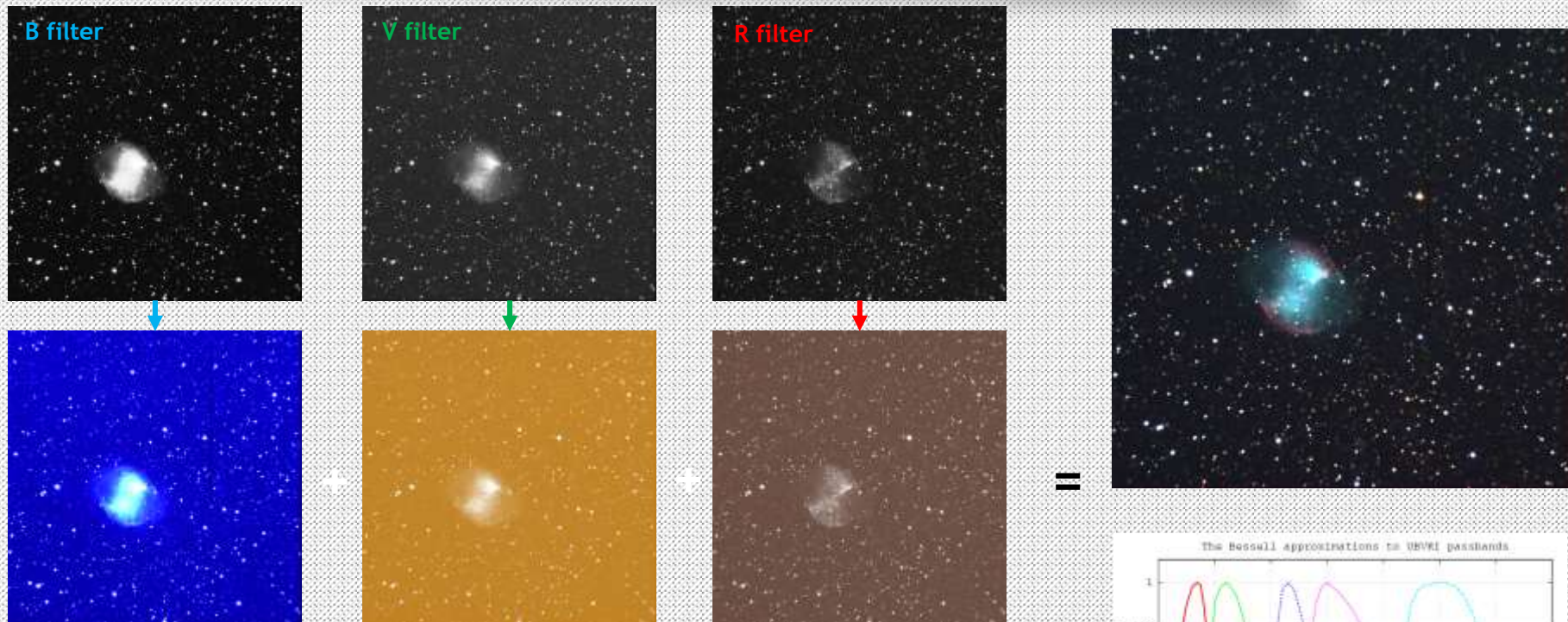
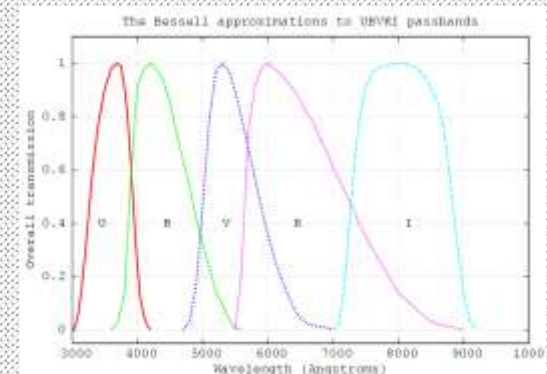


Figure - Dumbell nebula M27. Images acquired in B (left), V (middle) and R filters (right). Images acquired by AGO 70-cm telescope. Used exposure was 60s.



Thank you for your attention

