Possible contribution of the ISON project to the Open Universe Initiative in developing countries

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International Scientific Optical Network (ISON)

- Open voluntary project on self-financing basis directed on:

  – support existing observatories in former Soviet Union (FSU) countries and establishing new telescope facilities worldwide

  – enhance the international collaboration in the filed of optical observation of natural and man-made celestial objects

  – provide significant scientific output in space debris, asteroids, and Gamma-Ray Bursts afterglow

- ISON project is based on cooperation agreements between KIAM and participating institutions (42 observatories with 100 telescopes in 18 countries)
- Keldysh Institute of Applied Mathematics (KIAM), RAS coordinates the ISON project, maintains the database on space debris objects and provides conjunction analysis for Russian GEO satellites

ISON project milestones

- Start point is difficult situation in FSU observatories (obsolete telescopes, no CCD-camera, no enough staff)
- 70+ optical telescopes (apertures between 12.5 cm and 65 cm) were produced, 8 obsolete telescopes (apertures between 60 cm and 80 cm) were modernized and CCD camera were provided for 5 telescopes (70-cm – 2.6 m)
- Complete software set for telescope observations was elaborated (telescope and equipment control, CCD-frames processing, observation planning) and widely distributed (80% FSU observatories is using ISON software)
- Training courses for amateurs astronomers and observatory staff are regularly arranged
- Few famous scientists were involved to assign the tasks
- Group for engineering support of ISON activities is arranged

Scientific objectives of the ISON project

- Keldysh Institute of Applied Mathematics (KIAM), RAS coordinates the space debris research (develops the space debris population model at high orbits) and searching of new asteroids&comets (developing the surveys with small telescopes to reach the full sky coverage to detect fast NEAs missed in the dedicated asteroid surveys)
- Space Research Institute, RAS coordinates GRB researches and provides analysis of alert observations results
- Institute of Astronomy of Kharkiv National University, Ukraine coordinates the photometry observations of asteroids to investigate their physical properties (to discover binary asteroids, to research YORP effect, to support radar experiments)

Telescope building –more 70 telescopes

We ordered and participated into elaboration of few series of telescopes, mounts, domes, pavilions, focusers etc…:

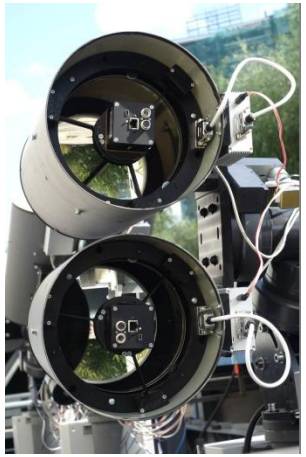
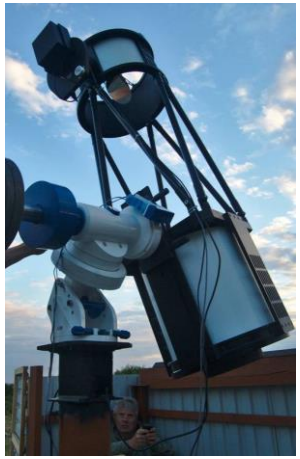
Genon (objectives 12.5 cm, 19.2 cm, 30 cm, Hamilton 22 cm, 25 cm, 40 cm, 50 cm), **SanTel** (Hamilton 25 cm, 40 cm, 65 cm), **ChV** (Newton 40 cm, 50 cm, mounts and domes), **DISON** (Hamilton 20 cm, Newton 25 cm, 40 cm, mounts, pavilions, focusers)





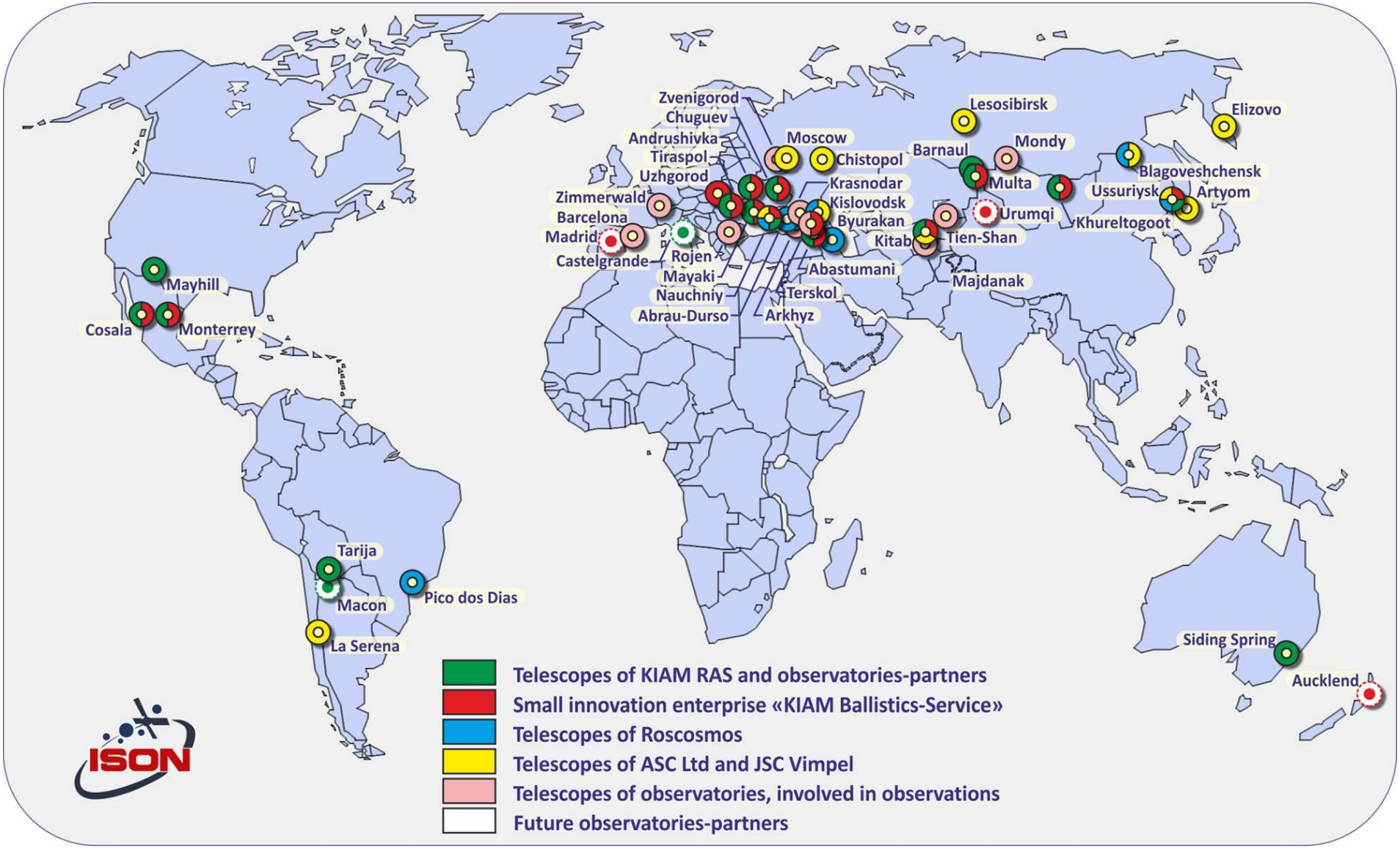




Regular ISON workshops&training courses (2009 Ukraine, 2011 Russia, 2015 Russia, 2016 Kazakhstan)

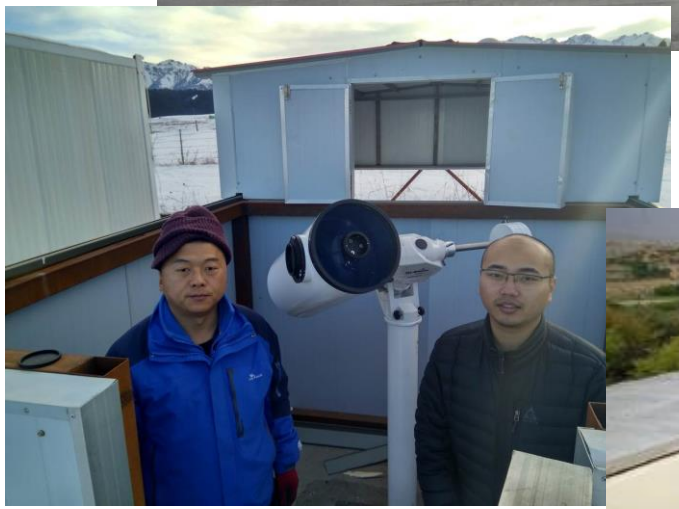
Map of observatories that send the data to KIAM

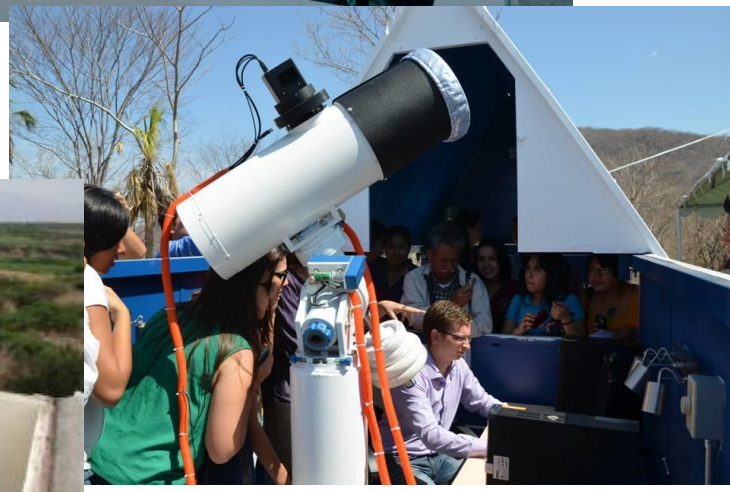


ISON experience:

- Adjusted full technology of observations – telescope production, software set, specialist training
- Small telescope set (20 cm – 25 cm) on automated mount may be installed and putted in operation very quickly by group of ISON specialists including the training of local staff
- It was developed the method of survey with small telescope having field of view 3.3 - 7 degrees to produce significant results
- There are the software for planning& scheduling of observations, measurements processing and analysis
- ISON scientists are able to assign the observation tasks, to interpret results and to prepare the publications with co-authorship of representatives of observatories
- There is the ISON group for engineering support and equipment repairing

Samples of telescope donations: Castelgrande (**Italy**), Monterrey (**Mexico**), Urumqi (**China**), Tarija (**Bolivia**), Cosala (**Mexico**)





UN-ISON

- Since 2008 annual reports at STSC COPUOS
- Outreach UNBSSI-ISON cooperation seminar was organized by UNOOSA and ISON during the 55th session of COPUOS in June 2012
- First contact of ISON with Open Universe Initiative took place during 60th session of COPUOS in June 2017

Possible contribution of the ISON project to the OU Initiative

- Assistance to developing countries in collaboration with OU initiative by:

  - donating small telescopes and establishing astronomy facilities (jointly with IAU?)

  - providing necessary training for specialists

  - arranging of observation campaigns for involvement of developing countries in fundamental space science

- Transference of some ISON observation results
- Elaboration of joint reference resources

Criteria for ranking of proposals to install ISON telescope

- Elaboration of page for submitting of requests on ISON telescope donation at OU Initiative web site
- For sites with good astroclimate (many observation nights, high altitude, minimal light pollution etc..)
- For site with good geographical position (Western and Sothern Hemisphere, close to equator etc..)
- For team wishing to cooperate in OU Initiative in UN-ISON scientific areas
- Sharing efforts – domes, computers etc.. It would be good the participation of IAU in part of observatories grant program

Which ISON data may be useful for OUI?

- CCD images obtained during asteroid and GRB observations (i.e. for searching of variable stars)
- Astrometry measurements for asteroids and comets are already send to Minor Planet Center of IAU
- Photometry curves for near-Earth asteroids?
- CCD images obtained from space debris observations can not be useful (starts are long tracks)
- Raw space debris measurements may be useful for many goals (i.e. motion theory development for object with high area to mass ratio is very topical goal). Not exist any open sources with space debris measurements
- Open database on space debris in OUI?

UNISON reference resources

- Full KIAM catalogue (on 5545 space objects at high orbits) can not be opened now, because of it fulfilled also with data from Roscosmos observatories
- But may be used for checking and comparison with discovered optical transients (i.e. dedicated web page may be created at OUI web site for downloading of coordinates of phenomena)
- Web page for identification of observed satellite or space debris object (it will be necessary to input measurements connected with time and to receive the answer which object was observed
- KIAM can process the space debris measurements of possible an Open database on space debris in OUI from donating ISON telescopes to determine the orbits of observed space objects

Conclusions

- ISON project elaborated inexpensive technological solutions for observations of space objects that already used for capacity building in international cooperative researches
- ISON research areas are topical for the UN COPUOS
- UN-ISON program of telescope donating and training courses for developing countries may be started as part of OU Initiative
- Some database and reference resources from ISON data may be elaborated as part of OU Initiative