Program of international scientific cooperation in field of space debris observations using optical facilities

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International Scientific Optical Network (ISON)

• Open non-government scientific project having goals
  – to provide reliable scientific output on space debris, asteroids and GRB afterglows
  – to support the astronomical observatories of Former Soviet Union (FSU) countries and to involve amateur astronomers in scientific activities
  – to improve the international collaboration between FSU observatories and scientific organization in other countries

• Cooperation already joins 23 observation facilities of various affiliation (Academy of Sciences, Universities, Scientific Institutions, Commercial Companies, Privates) coordinated by the Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences (KIAM)
ISON International Cooperation

- ISON collaborates now with institutions of 11 countries - Bolivia, Georgia, Moldova, Italy, Russia, Spain (ESA), Switzerland, Tajikistan, Ukraine, USA, Uzbekistan
- Preparatory works started to involve Armenia, Kazakhstan, Mexico, Mongolia, Venezuela,
- Negotiations are carried out with Argentina, Brazil, Latvia, Vietnam, Organization of United Nations
Forms of collaboration with ISON project

- Participation in regular ISON coordinated observations
- Joint observation campaigns to exchange the obtained results
- Arrangement of ISON observations for specific scientific goal or program for further joint publications
- Providing of software, elaborated under ISON project for further coordinated activities
- Installation of telescopes, elaborated under ISON project
- Modernization of non-operational obsolete telescopes
- Production of telescope under grant for future joint observations
Standart ISON telescopes:
19-cm VT-78e, 25-cm ORI-25, 40-cm ORI-40
Samples of collaboration:
50-cm ORI-50 in Ussuriysk under grant of MFTI
and 22-cm ORI-22 in Collepardo
Modernization of Zeiss-600 in Tarija (Bolivia) and Sanghlok (Tajikistan)
EOP-1 – standart space debris observatory under Roscosmos grant
Facilities of EOP-1 created under Roscosmos grant
50-cm and 65-cm telescopes elaborated under Roscosmos grant
Planned positions of dedicated optical facilities under Roscosmos grant
АСПОС ОКП
Сегмент мониторинга опасных ситуаций в области ГСО, ВЭО и СВО

Центр сбора, обработки и анализа научной информации по объектам техногенного происхождения
ISON structure and tasks

Optical facilities form three subsets:
- subsystem for surveys of the GEO region (down to 16\text{m})
- subsystem for tracking of the high orbit faint (fainter than 16\text{m}) space debris at GEO and GTO
- subsystem for tracking of bright GEO and HEO objects
- subsystem for asteroid research

Current primary tasks: regular GEO monitoring, new GEO and GTO faint objects discovering and tracking, maintenance as complete GEO objects database as possible

KIAM coordinates activities and analyze measurements
Samples of Coverage in GEO surveys for two 22-cm surveys telescopes – in Ussuriysk and Crimea (Nauchniy-1)

Right Ascension – Declination
2009/09/01-2010/03/01
Ussuriysk

Hour Angle – Declination
2008/01/01 – 2008/12/01
Nauchniy-1
Observed Individual GEO Objects Number (by night, Jan 2009 - Aug 2010)
Distribution of 1530 GEO Objects by Period and Inclination
Distribution of 1530 GEO objects by RAAN and Inclination
Distribution of 1699 HEO and MEO objects by Period and Inclination
Distribution of 1699 HEO and MEO objects by Period and Inclination
Distribution of average AMR value for 306 fragments

Distribution of average brightness for 546 fragments (including 341 object and 205 uncorrelated one-night tracks)
Distribution of High AMR objects by period and inclination
Directions of asteroid research

• Searching new asteroids
• Follow-up of NEA
• Photometry of NEA
• Discovering and investigating double NEA
• Investigation of YORP effect
• Improvement of data on NEA selected as radar target
NEA searching
Telescopes for photometry of NEA
Photometry of NEAs

NEA 2010 RN80, Comet Elenin C/2010 X1, 400 main belt asteroids were discovered in 2010. more 100 night of photometry of
Next grant of Roscosmos is on the way

• Elaboration of two EOP-2 (65-cm, 40-cm, 4x19 cm)
• Modernization of 2.6-m and 1-m Schmidt telescope of Buryakan observatory in Armenia (FOV of ZTA2.6 will be 1.3 degree, of AZT-10 will be 2.6 degree)
• Beginning of producing the 80-cm telescope
• Designing of 1.5-m telescope on base of AZT-33VM for North Caucasus
Modernization of Buryakan observatory, Armenia