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Committee on the Peaceful Uses of Outer Space
Scientific and Technical Subcommittee
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Agenda item 11
Near-Earth objects

Information on research in the field of near-earth objects carried out by Member States, international organizations and other entities

Note by the Secretariat[1]

Submission by the Czech Republic

[1] This document has not been formally edited. It will be edited, translated into all official languages of the United Nations and distributed as document A/AC.105/976/Add.1 after the forty-eighth session of the Scientific and Technical Subcommittee.

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II. Replies received from Member States

Czech Republic

[Original: English]

[6 January 2011]

Near-Earth Object (NEO) research is an expanding field of astronomy, important both for the Solar System science and for protecting human society from asteroid and comet hazard. An integral part of NEO discovery is astrometric follow-up fundamental for precise orbit computation and for the reasonable judging of future close encounters with the Earth including possible impact solutions. Two institutions are highly involved in NEO related activities in the Czech Republic.

The Klet Observatory2 in the South Bohemia region maintains the long-time observing program devoted to Near-Earth Asteroids (NEAs) and comets since 1992. It has ranked among the world´s most prolific professional NEO follow-up programmes. Considering development of NEO studies the KLENOT Project of the Klet Observatory has been started in 2002 to confirm and follow-up fainter and fast-moving NEOs as well as watching and studying Near-Earth comets behaviour, outbursts, fragmentation or splitting. A 1.06-m KLENOT telescope was build for this purpose. Equipment, technology, software and observing strategy has been developed for this project.

Results of the KLENOT Project obtained during its first phase from March 2002 to September 2008 during 346 observing nights consist of 13 342 positions of 1 369 NEAs, 222 of which were Potentially Hazardous Asteroids (PHAs) and 157 of which were Virtual Impactors (VIs) in the time of observations. A 34 newly discovered comets were confirmed (i.e. detected cometary features). A nucleus duplicity of comet C/2004 S1 (Van Ness) was detected and astrometric measurements of fragments of comet 73P/Schwassmann-Wachmann 3 during its 2006 close approach to the Earth were provided. As a by-product several NEAs and other unusual objects were discovered.

A fundamental improvement of the KLENOT telescope was started in autumn 2008. The new computer-controlled mount will substantially increase telescope-time efficiency, the number of observations, their accuracy and limiting magnitude. Special software has been upgraded for processing and developed for co-adding of multi-TIFF images. Future plans reflect also the role of astrometric follow-up in connection with the next generation surveys all over the world including space missions. The first testing images of this KLENOT Next Generation telescope were obtained in July 2010 and adjustment of the system (hardware and software) is in progress just now. In the meantime 0.57-m reflector in the second dome at Klet has been used for selected astrometric observations.

Moreover, one of the most important duties of NEOs scientists and research institutions is to maintain contact with the general public and media. NEO related issues have outstanding educational value and outreach potential. Considering both results of the Klet Observatory and our educational experience take part in outreach

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[2] Jana Ticha (PI), Milos Tichy, Michal Kocer, Michaela Honkova – science team members Klet Observatory, Czech Republic, http://www.klet.org

activities to bring clear, relevant and up to date information about NEO research and hazard mainly in the Czech Republic and the Central European region.

Asteroid studies at the Astronomical Institute3 of the Academy of Sciences of the Czech Republic (AS CR) are orientated to physical studies of asteroids, which is one of the most important research topics at the Astronomical Institute AS CR. As the NEA population is highly dynamic and many NEA properties are derived from their sources in the main belt of asteroids between Mars and Jupiter, scientists from Astronomical Institute AS CR study both these related asteroid populations.

Astronomy Institute AS CR main focus is on deriving asteroid properties and investigating mechanisms of asteroid formation and evolution. In its studies closely collaborates with a number of researchers in the world, so many of its findings are a result of team work involving collaborators from several countries. Among its recent most important findings (highlight results for pairs of asteroids4) both bound binary systems as well as dissolved pairs orbiting the Sun on separate orbits.

Using extensive photometric observational data, scientists from Astronomy Institute AS CR found that asteroids fission when they are spun up to critical rotation frequency and form asteroids pairs. Bound binary asteroid systems show similar characteristics with angular momentum content close to the critical limit for a body in a gravity regime, suggesting that they have formed from parent bodies spinning at the critical rate by disintegrate or mass shedding. A mechanism to spin the asteroid up to its critical rotation frequency is provided by the non-gravitational Yarkovsky–O'Keefe–Radzievskii–Paddack (YORP) effect of re-radiaton of absorbed solar light energy from an irregular body. An important implication of the studies of asteroid pairs, both bound and separated, is that asteroids are predominantly weak structures that are composed of pieces held together by self-gravitation only, with zero or negligible global tensile strength.

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[3] Pavel Spurny (Department head), Petr Pravec (Deputy head)
Astronomy Institute AS CR, Czech Republic, http://www.asu.cas.cz/interplanetary-matter-department

[4] Pravec, P., D. Vokrouhlický, D. Polishook, D. J. Scheeres, A. W. Harris, A. Galád, O. Vaduvescu, F. Pozo, A. Barr, P. Longa, F. Vachier, F. Colas, D. P. Pray, J. Pollock, D. Reichart, K. Ivarsen, J. Haislip, A. LaCluyze, P. Kušnirák, T. Henych, F. Marchis, B. Macomber, S. A. Jacobson, Yu. N. Krugly, A. V. Sergeev, A. Leroy, 2010. Formation of asteroid pairs by rotational fission, Nature 466, 1085-1088.
Pravec, P., D. Vokrouhlický, 2009. Significance analysis of asteroid pairs, Icarus 204, 580-588.
Scheirich, P., P. Pravec, 2009. Modeling of lightcurves of binary asteroids, Icarus 200, 531-547.
Pravec, P., et al., 2008. Spin rate distribution of small asteroids, Icarus 197, 497-504.