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DISTANT EKOs

The Kuiper Belt Electronic Newsletter

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NEWS & ANNOUNCEMENTS

The IAU has decided on the term "plutoid" for the class of Pluto-like objects:
`http://www.iau.org/public_press/news/release/iau0804/`
"Plutoids are celestial bodies in orbit around the Sun at a distance greater than that of Neptune that have sufficient mass for their self-gravity to overcome rigid body forces so that they assume a hydrostatic equilibrium (near-spherical) shape, and that have not cleared the neighbourhood around their orbit. The two known and named plutoids are Pluto and Eris."

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And speaking of Plutoids, TNO 136472 = 2005 FY9 has been named Makemake. The name comes from a mythology of the Rapa Nui people of Easter Island; it is the name of a god who was the creator of humanity and god of fertility. Thus named, it is the third Plutoid and the fourth dwarf planet in the solar system, which include Ceres, Pluto, and Eris.

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There was 1 new TNO discovery announced since the previous issue of *Distant EKOs*:

2007 TY430

and 4 new Centaur/SDO discoveries:

2008 HY21, 2008 HG67, 2008 LP17, 2008 KV42

Objects recently assigned numbers:
2007 JG43 = (187661)

Objects recently assigned names:
2005 FY9 = (136472) Makemake

Deleted/Re-identified objects:
2002 KY14 = 2007 UL126

Current number of TNOs: 1077 (including Pluto)
Current number of Centaurs/SDOs: 230
Current number of Neptune Trojans: 6

Out of a total of 1313 objects:
554 have measurements from only one opposition
534 of those have had no measurements for more than a year
281 of those have arcs shorter than 10 days
(for more details, see: `http://www.boulder.swri.edu/ekonews/objects/recov_stats.gif`)

PAPERS ACCEPTED TO JOURNALS

Visible Spectroscopy of the New ESO Large Program on Trans-Neptunian Objects and Centaurs. Part 1

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Aims: A second large observational program was started to improve our knowledge of the physical properties of Centaurs and trans-Neptunian objects, TNOs. The program is being executed in the facilities at the Cerro Paranal of the European Southern Observatory, ESO, in Chile.

Methods: Visible spectroscopy was carried out using FORS1 at the UT2 of the VLT telescope. We computed the spectral slope, S, for each object, and we searched for the possible existence of weak absorption features. We compared our data with those from the literature.

Results: We present spectra for 21 objects, 7 of them with no previously reported spectra. Our sample includes 5 Centaurs, 5 resonant objects, 8 classical TNOs, 2 detached objects, and 1 scattered disk object. There are significant differences between the distribution of spectral slopes for Centaurs and classical TNOs. The data presented here generally agree with previous published data. One exception is 60558 Echeclus, whose spectral slope is considerably smaller than previous measurements. Another interesting object is 47932 (2000 GN_{171}), which does not show evidence of a proposed feature at 0.7 μm. Most of the spectra are linear and featureless; however, the well-known bands of solid methane are detected in 136199 Eris spectra and some weak features are detected for a few other objects. The most interesting case is that of 2003 AZ_{84}, which has a feature at about 0.65 μm, maybe due to aqueous alteration.

To appear in: Astronomy & Astrophysics

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Visible Spectroscopy in the Neighborhood of 2003 EL_{61}

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The recent discovery of a group of trans-neptunian objects (TNOs) in a narrow region of the orbital parameter space and with surfaces composed of almost pure water ice, 2003 EL_{61} being its largest member, promises new and interesting results about the formation and evolution of the trans-neptunian belt (TNb) and the outer Solar System. The aim of this paper is to obtain information of the surface properties of two members of this group ((24835) 1995 SM_{55}, (120178) 2003 OP_{32}) and three potential members (2003 UZ_{117}, (120347) 2004 SB_{60} and 2005 UQ_{513}) and to use that in order to confirm or reject their association.

Results: We show in this paper visible spectra of five TNOs, obtained using the 3.58m Telescopio Nazionale Galileo at the "Roque de los Muchachos Observatory" (La Palma, Spain). The spectra of the five TNOs are featureless within the uncertainties and with colors from slightly blue to red ($-2 < S' < 18\%/0.1\mu$m). No signatures of any absorption are found. We confirm the association of 1995 SM_{55} and 2003 OP_{32} with the group of 2003 EL_{61} as their spectra are almost identical to that of 2003 EL_{61}. Only one of the three candidates, 2003 UZ_{117}, can be considered as a possible member of

the EL_{61}-group as its visible spectrum is compatible with a spectrum of a surface composed of almost pure water ice and no complex organics but this fact must be confirmed by near-infrared observations. The other two, 2004 SB_{60} and 2005 UQ_{513} are red and must be considered as interlopers.

To appear in: Astronomy & Astrophysics
For preprints, contact npinilla@tng.iac.es
or on the web at http://arxiv.org/abs/0807.2670

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The Ratio of Retrograde to Prograde Orbits: A Test for Kuiper Belt Binary Formation Theories

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With the discovery of Kuiper Belt binaries that have wide separations and roughly equal masses new theories were proposed to explain their formation. Two formation scenarios were suggested by Goldreich and collaborators: In the first, dynamical friction that is generated by a sea of small bodies enables a transient binary to become bound (L^2s mechanism); in the second, a transient binary gets bound by an encounter with a third body (L^3 mechanism).

We show that these different binary formation scenarios leave their own unique signatures in the relative abundance of prograde to retrograde binary orbits. This signature is due to stable retrograde orbits that exist much further out in the Hill sphere than prograde orbits. It provides an excellent opportunity to distinguish between the different binary formation scenarios observationally.

We predict that if binary formation proceeded while sub-Hill velocities prevailed, the vast majority of all comparable mass ratio binaries have retrograde orbits. This dominance of retrograde binary orbits is a result of binary formation via the L^2s mechanism, or any other mechanism that dissipates energy in a smooth and gradual manner. For super-Hill velocities binary formation proceeds via the L^3 mechanism which produces a roughly equal number of prograde and retrograde binaries. These predictions assume that subsequent orbital evolution due to dynamical friction and dynamical stirring of the Kuiper belt did not alter the sense of the binary orbit after formation.

To appear in: The Astrophysical Journal
For preprints, contact hes@astro.caltech.edu
or on the web at http://arxiv.org/abs/0803.0329

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The Scattered Disk as the Source of the Jupiter Family Comets

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The short period Jupiter family comets (JFCs) are thought to originate in the Kuiper Belt; specifically, a dynamical subclass of the Kuiper Belt known as the 'scattered disk' is argued to be the dominant source of JFCs. However, the best estimates from observational surveys indicate that this source may fall short by more than two orders of magnitude the estimates obtained from theoretical models of the dynamical evolution of Kuiper belt objects into JFCs. We re-examine the scattered disk as a source of the JFCs and make a rigorous estimate of the discrepancy. We find that

the uncertainties in the dynamical models combined with a change in the size distribution function of the scattered disk at faint magnitudes (small sizes) beyond the current observational limit offer a possible but problematic resolution to the discrepancy. We discuss several other possibilities: that the present population of JFCs is a large fluctuation above their long term average, that larger scattered disk objects tidally break-up into multiple fragments during close planetary encounters as their orbits evolve from the trans-Neptune zone to near Jupiter, or that there are alternative source populations that contribute significantly to the JFCs. Well-characterized observational investigations of the Centaurs, objects that are transitioning between the trans-Neptune Kuiper belt region and the inner solar system, can test the predictions of the non-steady state and the tidal break-up hypotheses. The classical and resonant classes of the Kuiper belt are worth re-consideration as significant additional or alternate sources of the JFCs.

To appear in: The Astrophysical Journal
For preprints, contact kvolk@lpl.arizona.edu
or on the web at http://arxiv.org/abs/0802.3913v2

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The Effect of Secular Resonance Sweeping in the Classical Kuiper Belt

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The Kuiper Belt is a disk of small icy objects orbiting the Sun beyond Neptune, and the region between 40–48 AU in the Kuiper Belt is supposed to consist of 'cold' objects on low inclination orbits, which is called the classical Kuiper Belt. But recently, observations show that a 'hot' population whose inclinations can be as large as 30° reside in this classical Kuiper Belt, and the secular resonance sweeping mechanism is a probable explanation: the residual solar nebula gas dispersal can cause secular resonance sweeping (SRS), when the location of a secular resonance crosses the classical Kuiper Belt, the inclinations of the classical Kuiper Belt objects (KBOs) can be pumped up. The inclination excitation due to SRS has been investigated in detail in the compact configuration of the solar system (the orbits of four giant planets are closer to each other). It is shown that the inclination excitation depends sensitively on the angle, δ, between the midplane of nebula gas and the invariable plane of solar system. If the midplane of nebula gas is coplanar with the invariable plane, i.e., $\delta = 0$, the inclination excitation is very small. But if the midplane of nebula gas is placed in the ecliptic plane, i.e., $\delta \approx 1.6°$, the inclinations of the classical KBOs can attain values above 30°, as long as the residual nebula gas's density is about 1% of the minimum mass nebula model and the dissipation timescale is around 1.7×10^7 years (e.g. T Tauri stars). Besides, by simulating the cases of more inclined Jupiter with respect to the invariable plane, and SRS along with the migration of giant planets, we show that the effects of both cases are much less than δ for exciting the inclinations of the classical KBOs.

Published in: Acta Astronomica Sinica, 49, 179 (2008 April)

PAPERS RECENTLY SUBMITTED TO JOURNALS

Ejecta Exchange, Color Evolution in the Pluto System, and Implications for KBOs and Asteroids with Satellites

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or on the web at http://arxiv.org/abs/0805.3482

CONFERENCE INFORMATION

Great Planet Debate (GPD)

August 14 - 16, 2008

Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland, USA

Scientists and educators will convene in Maryland this summer to explore a basic, but controversial, question: What is a planet?

The Great Planet Debate (GPD) conference includes two days (August 14-15) of scientific sessions to discuss and debate the processes leading to planet formation and the characteristics and criteria used to define and categorize planets. An open-to-the-public debate between Dr. Mark Sykes of the Planetary Science Institute and Dr. Neil deGrasse Tyson of the American Museum of Natural History is scheduled on the afternoon of August 14th.

During the first two days of the conference, speakers will present what we have learned about planetary bodies over more than 40 years of robotic exploration of the Solar System and what we are learning about planets around other stars. The IAU's dynamical definition of a planet will be presented, as well as an alternative geophysical definition. The utility of each will be debated, along with other potential planet definitions.

The invited speakers are leading researchers in the field of planetary system formation and evolution. The schedule of talks can be found at: http://gpd.jhuapl.edu/schedule/

The third day of the meeting will be an Educator Workshop to discuss how the question of "The Great Planet Debate" should be treated in schools and how that can be used as a springboard to discuss science as a process, as well as other topics in planetary science.

Deadline for Abstracts and Early Registration: June 27, 2008

To register go to: http://gpd.jhuapl.edu/

Meeting Organizers: Mark Sykes, Hal Weaver, and Keith Noll

The *Distant EKOs* Newsletter is dedicated to provide researchers with easy and rapid access to current work regarding the Kuiper belt (observational and theoretical studies), directly related objects (e.g., Pluto, Centaurs), and other areas of study when explicitly applied to the Kuiper belt.

We accept submissions for the following sections:
⋆ Abstracts of accepted papers
⋆ Titles of submitted (but not yet accepted) papers and conference articles
⋆ Thesis abstracts
⋆ Short articles, announcements, or editorials
⋆ Status reports of on-going programs
⋆ Requests for collaboration or observing coordination
⋆ Table of contents/outlines of books
⋆ Announcements for conferences
⋆ Job advertisements
⋆ General news items deemed of interest to the Kuiper belt community

A LaTeX template for submissions is appended to each issue of the newsletter, and is sent out regularly to the e-mail distribution list. Please use that template, and send your submission to:

`ekonews@boulder.swri.edu`

The *Distant EKOs* Newsletter is available on the World Wide Web at:

`http://www.boulder.swri.edu/ekonews`

Recent and back issues of the newsletter are archived there in various formats. The web pages also contain other related information and links.

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Moving ... ??

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`ekonews@boulder.swri.edu`