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DISTANT EKOs

The Kuiper Belt Electronic Newsletter

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NEWS & ANNOUNCEMENTS

You may have missed this minor news item (if you were locked in a cave for the last month), but the IAU voted on a definition of "planet", and Pluto did not make the cut:
`http://www.iau2006.org/mirror/www.iau.org/iau0601/iau0601_release.html`
There is dissension, to say the least:
`http://www.ipetitions.com/petition/planetprotest/`

I was going to editorialize, but really, what signal could I inject in the noise that hasn't already been said? So instead, I trolled around for interesting (and fun) reading of professional and public discussions of this issue:
`http://astro.cas.cz/nuncius/appendix.html`
`http://www.worth1000.com/cache/contest/contestcache.asp?contest_id=11570`
`http://www.badastronomy.com/bablog/2006/08/24/breaking-news-pluto-not-a-planet/`
`http://science.slashdot.org/article.pl?sid=06/08/24/148245`
`http://www.livescience.com/blogs/2006/08/17/those-wild-and-crazy-astronomers/`
`http://www.space.com/scienceastronomy/060818_planet_newprop.html`
`http://www.youtube.com/watch?v=b-7l2G2a6js`
`http://www.purevolume.com/jimmyandthekeyz/blog`

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There will be a special session on Kuiper belt objects to be held at the American Geophysical Union's meeting in San Francisco (December 11–15, see `http://www.agu.org/meetings/fm06/`). All readers with an interest in contributing are encouraged to submit an abstract by the **7 September 2006** deadline. The web page at `http://www-691.gsfc.nasa.gov/cosmic.ice.lab/agu-f06.htm` has both a session description and an abstract submission link. We hope to see readers of the Distant EKOs Newsletter in San Francisco in December for an exciting exchange of research results on KBOs.

The Session Conveners,

Reggie Hudson, Eckerd College, Florida (`hudsonrl@eckerd.edu`)
Marla Moore, NASA Goddard (`marla.h.moore@nasa.gov`)
John Cooper, NASA Goddard (`John.F.Cooper@nasa.gov`)

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There were 8 new TNO discoveries announced since the previous issue of *Distant EKOs*:

2004 UX10, 2005 RN43, 2005 RQ43, 2005 RR43, 2005 RS43, 2005 SC278, 2005 SE278, 2005 SF278

and 8 new Centaur/SDO discoveries:

2004 QQ26, 2005 RL43, 2005 RO43, 2005 RM43, 2005 RP43, 2005 SA278, 2005 SD278, 2005 TB190

Objects recently assigned numbers:

2001 XT254 = (131696)
2005 PQ21 = (134210)
1999 CE119 = (129746)
1999 HR11 = (129772)
2000 JG81 = (130391)
2001 FL194 = (131318)
2001 XH255 = (131697)
2001 XS254 = (131695)
2003 FB128 = (133067)

Reclassified objects:

2000 GK147 (TNO → SDO)
2005 PU21 (TNO → SDO)
2006 HO122 (TNO → SDO)
2006 HQ122 (TNO → SDO)
2006 HR122 (TNO → SDO)

Current number of TNOs: 1015 (including Pluto)
Current number of Centaurs/SDOs: 182
Current number of Neptune Trojans: 4
Current number of satellites: 21 around 17 objects

Out of a total of 1201 objects:

518 have measurements from only one opposition
469 of those have had no measurements for more than a year
250 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

A Stability Study of Pluto's Moon System

I. Nagy[1], A. Süli[1], and B. Érdi[1]

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The dynamical structure of the orbital element space of the Pluto-Charon system is studied in the model of the spatial circular restricted three-body problem by using numerical methods. With the two newly discovered small satellites S/2005 P1 and S/2005 P2, the PlutoCharon system can be considered as the first known binary system in which celestial bodies move in P-type orbits. It is shown that the two satellites are in the stable region of the orbital element space and their origin by capture is unlikely. Also the large mass parameter allows the satellites to be regarded as a model of a new class of exoplanets orbiting around stellar binary systems.

Published in: Monthly Notices of the Royal Astronomical Society, 370, L19 (July 2006)
For preprints, contact I.Nagy@astro.elte.hu

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Brownian Motion in Planetary Migration

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[2] Sloan Research Fellow

A residual planetesimal disk of mass 10–100 Earth masses remained in the outer solar system following the birth of the giant planets, as implied by the existence of the Oort cloud, coagulation requirements for Pluto, and inefficiencies in planet formation. Upon gravitationally scattering planetesimal debris, planets migrate. Orbital migration can lead to resonance capture, as evidenced here in the Kuiper and asteroid belts, and abroad in extra-solar systems. Finite sizes of planetesimals render migration stochastic ("noisy"). At fixed disk mass, larger (fewer) planetesimals generate more noise. Extreme noise defeats resonance capture. We employ order-of-magnitude physics to construct an analytic theory for how a planet's orbital semi-major axis fluctuates in response to random planetesimal scatterings. To retain a body in resonance, the planet's semi-major axis must not random walk a distance greater than the resonant libration width. We translate this criterion into an analytic formula for the retention efficiency of the resonance as a function of system parameters, including planetesimal size. We verify our results with tailored numerical simulations. Application of our theory reveals that capture of Resonant Kuiper belt objects by a migrating Neptune remains effective if the bulk of the primordial disk was locked in bodies having sizes less than O(100) km and if the fraction of disk mass in objects with sizes greater than 1000 km was less than a few percent. Coagulation simulations produce a size distribution of primordial planetesimals that easily satisfies these constraints. We conclude that stochasticity did not interfere with, nor modify in any substantive way, Neptune's ability to capture and retain Resonant Kuiper belt objects during its migration.

To appear in: The Astrophysical Journal
For preprints, contact rmurray@astron.berkeley.edu, echiang@astron.berkeley.edu
or on the web at http://astro.berkeley.edu/~rmurray/publications.html

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Low Phase Angle Effects in Photometry of Trans-Neptunian Objects: 20000 Varuna and 19308 (1996 TO66)

I.N. Belskaya[1,2], J.L. Ortiz[3], P. Rousselot[1], V. Ivanova[4], G. Borisov[4], V.G. Shevchenko[2], and N. Peixinho[5]

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[5] GAUC, Observatório Astronómico da Universidade de Coimbra, P-3040 Coimbra, Portugal

We present the results of photometric observations of trans-neptunian object 20000 Varuna, which were obtained during 7 nights in November 2004–February 2005. The analysis of new and available photometric observations of Varuna reveals a pronounced opposition surge at phase angles less than 0.1 deg with amplitude of 0.2 mag relatively to the extrapolation of the linear part of magnitudephase dependence to zero phase angle. The opposition surge of Varuna is markedly different from that of dark asteroids while quite typical for moderate albedo Solar System bodies. We find an indication of variations of the scattering properties over Varuna's surface that could result in an increase of the lightcurve amplitude toward zero phase angle. It is shown that a similar phase effect can be responsible for lightcurve changes found for TNO 19308 (1996 TO66) in 1997–1999.

Published in: Icarus, 184, 277 (2006 September)

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Visible Spectroscopy of 2003 UB_{313}: Evidence for N_2 Ice on the Surface of the Largest TNO?

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The recent discovery of two large trans-Neptunian objects (TNOs) 2003 UB_{313} and 2005 FY_9, with surface properties similar to those of Pluto, provides an exciting new laboratory for the study of processes considered for Pluto and Triton: volatile mixing and transport; atmospheric freeze-out and escape, ice chemistry, and nitrogen phase transitions. We studied the surface composition of TNO 2003 UB_{313}, the first known TNO larger than Pluto. We report a visible spectrum covering the 0.35-0.95 μm spectral range, obtained with the 4.2m William Herschel Telescope at "El Roque de los Muchachos" Observatory (La Palma, Spain). The visible spectrum of this TNO presents very prominent absorptions bands formed in solid CH_4. At wavelengths shorter than 0.6 μm the spectrum is almost featureless and slightly red ($S' = 4\%$). The icy-CH_4 bands are significantly stronger than those of Pluto and slightly weaker than those observed in the spectrum of another giant TNO, 2005 FY_9, implying that methane is more abundant on its surface than in Pluto's and close to that of the surface of 2005 FY_9. A shift of 15 $\pm$3 Å relative to the position of the bands of the spectrum of laboratory CH_4 ice is observed in the bands at larger wavelengths (e.g. around 0.89 μm), but not at shorter wavelengths (the band around 0.73 μm is not shifted) this may be evidence for a vertical compositional gradient. Purer methane could have condensed first while 2003 UB_{313} moved towards aphelion during the last 200 years, and as the atmosphere gradually collapsed, the composition became more nitrogen-rich as

the last, most volatile components condensed, and CH_4 diluted in N_2 is present in the outer surface layers.

To appear in: Astronomy & Astrophysics
For preprints, contact licandro@ing.iac.es
or available online at: http://arxiv.org/abs/astro-ph/0608044

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Occultation of X-rays from Scorpius X-1 by Small Trans-Neptunian Objects

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Since the discovery of the trans-neptunian objects (TNOs) in 1992, nearly one thousand new members have been added to our Solar System, several of which are as big as—or even larger than—Pluto. The properties of the population of TNOs, such as the size distribution and the total number, are valuable information for understanding the formation of the Solar System, but direct observation is only possible for larger objects with diameters above several tens of kilometres. Smaller objects, which are expected to be more abundant, might be found when they occult background stars, but hitherto there have been no definite detections. Here we report the discovery of such occultation events at millisecond timescales in the X-ray light curve of Scorpius X-1. The estimated sizes of these occulting TNOs are 100 m. Their abundance is in line with an extrapolation of the distribution of sizes of larger TNOs

Published in: Nature, 442, 660 (2006 Aug 10)
For preprints, contact hkchang@phys.nthu.edu.tw

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Planetesimals To Brown Dwarfs: What is a Planet?

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The past 15 years have brought about a revolution in our understanding of our Solar System and other planetary systems. During this time, discoveries include the first Kuiper belt objects (KBOs), the first brown dwarfs, and the first extrasolar planets. Although discoveries continue apace, they have called into question our previous perspectives on planets, both here and elsewhere. The result has been a debate about the meaning of the word "planet" itself. It is clear that scientists do not have a widely accepted or clear definition of what a planet is, and both scientists and the public are confused (and sometimes annoyed) by its use in various contexts. Because "planet" is a very widely used term, it seems worth the attempt to resolve this problem. In this essay, we try to cover all the issues that have come to the fore and bring clarity (if not resolution) to the debate.

Published in: Annual Review of Earth and Planetary Sciences, 34, 193 (2006 May)
Preprints available on the web at http://arxiv.org/abs/astro-ph/0608417

PAPERS RECENTLY SUBMITTED TO JOURNALS

The Diverse Solar Phase Curves of Distant Icy Bodies. Part I: Photometric Observations of 18 Trans-Neptunian Objects, 7 Centaurs, and Nereid

David L. Rabinowitz[1], **Bradley E. Schaefer**[2], **Suzanne W. Tourtellotte**[3]

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Submitted to: The Astronomical Journal

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or on the web at http://arxiv.org/abs/astro-ph/0605745

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First Constraints on Rings in the Pluto System

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Submitted to: The Astronomical Journal

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or on the web at http://arxiv.org/abs/astro-ph/0608036

OTHER PAPERS OF INTEREST

Dust Dynamics, Surface Brightness Profiles, and Thermal Spectra of Debris Disks: The Case of AU Mic

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Published in: The Astrophysical Journal, 648, 652

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CONFERENCE CONTRIBUTIONS

Catalogue of Planetary Objects. Version 2006.0

O.V. Zakhozhay[1], **V.A. Zakhozhay**[1], **and Yu.N. Krugly**[1]

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Published in: Proceedings of the 13th Young Scientists' Conference on Astronomy and Space Physics, held in Kyiv, Ukraine, April 25-29, 2006, (p. 122)

Preprints available on the web at http://arxiv.org/abs/astro-ph/0607184

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`