Issue No. 27 *January 2003*

DISTANT EKOs

The Kuiper Belt Electronic Newsletter

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NEWS & ANNOUNCEMENTS

The discovery that 2001 QC298 is a possible binary TNO was announced in IAUC 8034 by Noll et al.. The object appears elongated in four HST/NICMOS images, with image analysis suggesting two components with separation of 0.17 ± 0.08 arcsec (5000 ± 2000 km).
IAUC: `http://cfa-www.harvard.edu/iauc/08000/08034.html`

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There were 34 new TNO discoveries announced since the previous issue of the *Distant EKOs* Newsletter:

> 2002 VA95, 2002 VB95, 2002 VC95, 2002 VD95, 2002 VE95, 2002 VZ94, 2002 MS4, 2002 VR128, 2002 VD130, 2002 VE130, 2002 VF130, 2002 VS130, 2002 VT130, 2002 VU130, 2002 VA131, 2002 VB131, 2002 VC131, 2002 VD131, 2002 VE131, 2002 VF131, 2002 VV130, 2002 VW130, 2002 VX130, 2002 VY130, 2002 VZ130, 2002 XD91, 2002 XE91, 2002 XF91, 2002 XG91, 2002 XH91, 2002 XJ91, 2002 WC19, 2002 XV93, 2002 XW93

and 5 new Centaur/SDO discoveries:

> 2002 VQ94, 2002 QX47, 2002 VR130, 2002 VG131, 2002 XU93

Reclassified objects:
2002 GG32 (TNO $\rightarrow$ SDO)
2000 YU1 (SDO $\rightarrow$ TNO)
2002 VQ94 (Centaur $\rightarrow$ SDO)

Objects recently assigned numbers:
1998 QM107 = (49036)
1995 TL8 = (48639)
1999 RA215 = (49673)
2002 LM60 = (50000)

Objects recently assigned names:
2002 LM60 = Quaoar

Current number of TNOs: 651 (and Pluto & Charon, and 8 other TNO binary companions)
Current number of Centaurs/SDOs: 127

PAPERS ACCEPTED TO JOURNALS

Orbit Distribution Nature of Kuiper Belt Objects

Q.-X. Nie

[*Abstract not available. — Ed.*]

Published in: Acta Astronomica Sinica, 43, 375

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The Plane of the Edgeworth-Kuiper Belt

Simon J. Collander-Brown[1], **Mario D. Melita**[2],
Iwan P. William[2], **and Alan Fitzsimmons**[1]

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We examine possible locations for the primordial disk of the Edgeworth-Kuiper Belt (EKB), using several subsets of the known objects as markers of the total mass distribution. Using a secular perturbation theory, we find that the primordial plane of the EKB could have remained thin enough to escape detection only if it is clustered very closely about the invariant plane of the Solar System.

To appear in: Icarus

For preprints, contact `M.D.Melita@qmul.ac.uk`

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Dynamics of the Edgeworth-Kuiper Belt beyond 50 AU: Spread of a Primordial Thin Disk

Adrián Brunini[1]

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In this paper we report numerical simulations of the dynamical evolution of the region $a >$ 50 AU. We found that some dynamical effects such as high-order secular resonances with the rate of precession of Neptune's node of the form $k\dot{\Omega} - \dot{\Omega}_{Nep}$ with $k = 4, 5, ...$ or combined mean motion resonances with Uranus and Neptune of the form $kn_N + jn_U + mn \sim 0$ may spread a very thin primordial disk in this region after 4.5 Gy of evolution by a factor of up to 2.

To appear in: Astronomy & Astrophysics

For preprints, contact `abrunini@fcaglp.unlp.edu.ar`

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The Existence of a Planet Beyond 50 AU and the Orbital Distribution of the Classical Edgeworth-Kuiper-Belt Objects

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We study the effects of a Mars-like planetoid with semimajor axis at about ~60 AU orbiting embedded in the primordial Edgeworth-Kuiper Belt (EKB). The origin of such an object can be explained in the framework of our current understanding of the origin of the outer Solar System, and a scenario for the orbital transport mechanism to its present location is given. The existence of such an object would produce a gap in the EKB distribution with an edge at about 50 AU, which seems to be in agreement with the most recent observations. No object has been detected so far at low eccentricities with semimajor axes beyond 50 AU, even though, the present observing capabilities would allow an eventual detection (Gladman *et al.* 1998, Jewitt *et al.* 1998, Chiang *et al.* 1999, Allen *et al.* 2000, Trujillo *et al.* 2001, Gladman *et al.* 2001a, Trujillo and Brown 2001). Finally, ranges for the magnitude and proper motion of the proposed object are given.

Published in: Icarus, 160, 32 (2002 November)

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The Origin of the Kuiper Belt High Inclination Population

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I simulate the orbital evolution of the four major planets and a massive primordial planetesimals disk composed of 10^4 objects, which perturb the planets but not themselves. As Neptune migrates by energy and angular momentum exchange with the planetesimals, a large number of primordial Neptune scattered objects are formed. These objects may experience secular, Kozai and mean motion resonances that induce temporary decrease of their eccentricities. Because planets are migrating, some planetesimals can escape those resonances while in a low eccentricity incursion thus avoiding the return path to Neptune close encounter dynamics. In the end, this mechanism produces stable orbits with high inclination and moderate eccentricities. The so formed population together with the objects coming from the classical resonance sweeping process originate a bimodal distribution for the Kuiper Belt orbits. The inclinations obtained by the simulations can attain values above 30° and their distribution resembles a debiased distribution for the high inclination population coming from the real classical Kuiper Belt.

To appear in: Icarus

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Dynamical Models of Kuiper Belt Dust in the Inner and Outer Solar System

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We report several results related to the dynamical evolution of dust produced in the Kuiper Belt (KB). We show that its particle size frequency distribution in space is greatly changed from its distribution at production, due to the combined effects of radiation forces and the perturbations of the planets. We estimate the contribution of KB dust to the zodiacal cloud by calculating its number density radial profile near the ecliptic. We also study the contribution of KB dust to the population of IDPs collected at Earth, by calculating geocentric encountering velocities and capture rates. Our models show, in contrast with previous studies, that KB dust grains on Earth-crossing orbits have high eccentricities and inclinations, and therefore their encountering velocities are similar to cometary grains and not to asteroidal grains. We estimate that at most 25% in number of captured IDPs have cometary *or* KB origin; the KB contribution may be as low as 1-2%. We present the velocity field of KB dust throughout the Solar System; this, together with the number density radial profile, is potentially useful for planning spacecraft missions to the outer Solar System.

To appear in: The Astronomical Journal

For preprints, contact `amaya@as.arizona.edu`

or on the web at `http://www.lpl.arizona.edu/people/faculty/malhotra2.html`

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Observations of Centaur 8405 Asbolus: Searching for Water Ice

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Near-infrared spectra of Centaur 8405 Asbolus have been obtained, covering the whole rotational period. Complementary photometry and visible spectroscopy have also been performed. The aim of this project was to confirm or refute the water ice detection on one side of Asbolus reported by Kern et al. (2000 Astrophys. J., 542, L155–L159). We found no absorption feature at any rotational phase of Asbolus. Our study is the first in-depth investigation of a centaur over a complete rotational period. Our results seem also to indicate that a change in the slope from 0.8 to 1.0 μm may occur in Asbolus spectrum.

Published in: Icarus, 160, 59 (2002 November)

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CCD Photometry of Distant Comets. III. Ensemble Properties of Jupiter-family Comets

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We describe the results of a ground-based observational "snapshot" study of Jupiter-family comets in the heliocentric range 2.29 AU $\leq R_h \leq$ 5.72 AU. Results are presented based on observations from the 1m JKT on the island of La Palma. A total of 25 comets were targeted with 15 being positively detected. Broad-band VRI photometry was performed to determine dimensions, colour indices, and dust production rates in terms of the "Afρ" formalism. The results for selected comets are compared with previous investigations. Ensemble properties of the Jupiter-family population have been investigated by combining the results presented here with those of Lowry et al. (1999), and Lowry & Fitzsimmons (2001). We find that the cumulative size distribution of the Jupiter-family comets can be described by a power law of the form $\Sigma(> r) \sim r^{-1.6\pm0.1}$. This size distribution is considerably shallower than that found for the observed Edgeworth-Kuiper belt objects, which may reflect either an intrinsic difference at small km-sizes in the belt, or the various processes affecting the nuclei of comets as their orbits evolve from the Edgeworth-Kuiper belt to the inner Solar system. Also, there would appear to be no correlation between nuclear absolute magnitude and perihelion distance. Finally, for the sample of active comets, there is a distinct correlation between absolute R band magnitude and perihelion distance, which can be explained by either a discovery bias towards brighter comets or in terms of "rubble" mantle formation.

Published in: Astronomy & Astrophysics, 397, 329 (2003 January)
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or on the web at `http://www.edpsciences.org/articles/aa/abs/2003/01/aa2263/aa2263.html`

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Regarding the Putative Eccentricity of Charon's Orbit

S. Alan Stern[1], **William F. Bottke**[1], **and Harold F. Levison**[1]

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Based on astrometry from an orbit derived by HST imagery, Charon's orbital eccentricity has been reported to be in the range of 0.003–0.008 (Tholen & Buie 1997, Icarus, 125, 245). Solar and planetary tides are orders of magnitude too small to induce the reported eccentricity (Weissman et al. 1989, GRL, 16, 1241). This non-zero value, if correct, therefore indicates some significant forcing against the two-body tidal equilibrium value, which should formally be zero. Here we follow up on a preliminary study (Levison & Stern 1995, LPSC, 26, 841) to investigate whether the reported eccentricity of Charon's orbit could be due to gravitational perturbations by KBO flybys through the Pluto-Charon system and KBO impacts directly onto Pluto and Charon. We find it is unlikely that Charon's reported eccentricity could be caused by this effect. Although we cannot rule out some additional source of eccentricity excitation (e.g., an undiscovered satellite in the system, or a Kozai resonance), our analysis indicates it is plausible that Charon's actual orbital eccentricity is substantially smaller than the 0.003 lower limit reported previously.

To appear in: The Astronomical Journal (2003 February)
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On the Origin of Binary Transneptunian Objects

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The observed transneptunian binaries, with components of comparable mass and large separations, cannot be the result of collisions in the present dynamical environment of the Kuiper belt. They could be produced by collision of two planetesimals within the sphere of influence of a third body during low-velocity accretion in the solar nebula. Thus, they are primordial.

Published in: Icarus, 160, 212 (2002 November)

For preprints, contact `sjw@psi.edu`

PAPERS RECENTLY SUBMITTED TO JOURNALS

Dynamical Evolution of Trans-Neptunian Objects Near the 3/4 Exterior Resonance

Thomas A. Kotoulas[1] **and John D. Hadjidemetriou**[1]

[1] University of Thessaloniki, Department of Physics, GR-541 24 Thessaloniki, Greece

Submitted to: Earth, Moon, and Planets

Preprints available on the web at `http://users.auth.gr/~hadjidem/publ.html`

OTHER PAPERS OF INTEREST

Hefty Discovery: Finding a Kuiper Belt King

Ron Cowen[1]

[1] Science News, Washington D.C., USA

Science News 162, 228 (2002 October 12)

On the web at `http://www.sciencenews.org/20021012/fob3.asp`

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A New Kuiper Belt Kingpin

J. Kelly Beatty[1]

[1] Sky Publishing Corporation, 49 Bay State Road Cambridge, MA 02138-1200 USA

Sky & Telescope, 104, 24 (2002 December)

On the web at `http://skyandtelescope.com/news/current/article_753_1.asp`

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Seeing Double in the Kuiper Belt

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Nature, 420, 618 (2002 December 12)

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Evolution of Planetesimal Discs and Planets Migration

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To appear in: Monthly Notices of the Royal Astronomical Society

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On the Origin of Comet C/1999 S4 LINEAR

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[1] Universidad Complutense de Madrid, Ciudad Universitaria, 28040 Madrid, Spain

Astronomy & Astrophysics, 395, 697 (2002 November)

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`

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Moving ... ??

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