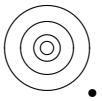
Issue No. 57 *March 2008*

DISTANT EKOs



The Kuiper Belt Electronic Newsletter

Edited by: Joel Wm. Parker

ekonews@boulder.swri.edu www.boulder.swri.edu/ekonews

CONTENTS

NEWS & ANNOUNCEMENTS

In IAUC 8922 Noll et al. report that 2006 SF369 is a binary, with a separation = 0.109 arcsec and a magnitude difference between the two components of < 0.1 mag.

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There were 2 new TNO discoveries announced since the previous issue of *Distant EKOs*:

2007 XV50, 2007 TH422

9 new Centaur/SDO discoveries:

2007 TJ422, 2007 UL126, 2007 UM126, 2007 VH305, 2007 TG422, 2007 UK126, 2007 TK422, 2007 VJ305, 2007 VK305

and 1 new Neptunian Trojan discovery:

2007 VL305

Reclassified objects:

2004 PG115 (TNO → SDO)

Deleted/Re-identified objects:

2007 RM283 = 2006 QQ180

Current number of TNOs: 1074 (including Pluto)
Current number of Centaurs/SDOs: 223
Current number of Neptune Trojans: 6

Out of a total of 1303 objects:
555 have measurements from only one opposition
536 of those have had no measurements for more than a year
278 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

174P/Echeclus: A Strange Case of Outburst

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Context. More than ten Centaurs are now known to have cometary activity at large heliocentric distance (i.e. $\simeq$ 5–13 AU). Among these objects, 174P/Echeclus which showed cometary activity at 13 AU from the Sun, is a unique case, because of: (i) the amplitude of its outburst, (ii) the source of cometary activity that appears distinct from Echeclus itself.

Aims. This paper aims at investigating the physical conditions that have led to this unusual outburst. The purpose is also to quantify this phenomenon and to provide observational constraints for its modeling.

Methods. We use observations from different telescopes, performed before, during, and after the outburst. We performed the main observations on March 23 and 30, 2006, with the 8.2-m ESO Very Large Telescope and FORS 1 instrument. They consist of visible images and spectra.

Results. Our main results are: (i) a cometary source distinct from Echeclus itself that presents a brightness distribution compatible with a diffuse source; (ii) a total dust production rate $Q_{dust} \simeq 86\ \mathrm{kg\,s^{-1}}$ and a parameter $Af\rho \simeq 10,000$ cm; (iii) no emission lines (CN and C_2) can be detected in the visible range; (iv) the upper limits for the CN and C_2 production rates are $\simeq 3.8 \times 10^{25}$ and $\simeq 10^{26}$ molecules $\mathrm{s^{-1}}$ respectively; (v) we detected no Echeclus' satellite before the outburst up to $M_R \simeq 26$; (vi) the upper limit for the object generating the coma is about 8 km in diameter; (vii) and we detected no cometary activity one year later, in March 2007.

Published in: Astronomy & Astrophysics, 480, 543 (2008 March)
For reprints, contact rousselot@obs-besancon.fr
or on the web at http://arxiv.org/abs/0803.1381

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Masses of Nix and Hydra

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A four-body orbit solution for the Pluto system yields GM values of 870.3 ± 3.7, 101.4 ± 2.8, 0.039 ± 0.034, and 0.021 ± 0.042 km^3 s^{-2} for Pluto, Charon, Nix, and Hydra, respectively. Assuming a Charon-like density of 1.63 gm cm^{-3}, the implied diameters for Nix and Hydra are 88 and 72 km, leading to visual geometric albedos of 0.08 and 0.18, respectively, though with considerable uncertainty. The eccentricity of Charon's orbit has a significant nonzero value; however, the 0.030 ± 0.009 deg yr^{-1} rate at which the line of apsides precesses is insufficient to explain the difference in the longitude of periapsis seen in the orbits fitted to the 1992–1993 and 2002–2003 data sets. The mean orbital periods for Hydra, Nix, and Charon are in the ratios of $6.064 \pm 0.006 : 3.991 \pm 0.007 : 1$, but we have not identified any resonant arguments that would indicate the existence of a mean motion resonance between any pairs of satellites.

Published in: The Astronomical Journal, 135, 777 (2008 March)
Preprint available on the web at: http://arxiv.org/abs/0712.1261

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The Kuiper Belt Luminosity Function from $m_R = 21$ to 26

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We have performed an ecliptic imaging survey of the Kuiper belt with our deepest and widest field achieving a limiting flux of $m(g')_{50\%} \sim 26.4$, with a sky coverage of 3.0 square-degrees. This is the largest coverage of any other Kuiper belt survey to this depth. We detect 72 objects, two of which have been previously observed. We have improved the Bayesian maximum likelihood fitting technique presented in Gladman et al. (1998) to account for calibration and sky density variations and have used this to determine the luminosity function of the Kuiper belt. Combining our detections with previous surveys, we find the luminosity function is well represented by a single power-law with slope $\alpha = 0.65 \pm 0.05$ and an on ecliptic sky density of 1 object per square-degree brighter than $m_R = 23.42 \pm 0.13$. Assuming constant albedos, this slope suggests a differential size-distribution slope of 4.25 ± 0.25, which is steeper than the Dohnanyi slope of 3.5 expected if the belt is in a state of collisional equilibrium. We find no evidence for a roll-over or knee in the luminosity function and reject such models brightward of $m(R) \sim 24.6$.

To appear in: Icarus

For preprints, contact `wesley.fraser@nrc.ca`
or on the web at `http://arxiv.org/abs/0802.2285`

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N_2 Escape Rates from Pluto's Atmosphere

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Hydrodynamic escape of N_2 molecules from Pluto's atmosphere is calculated under the assumption of a high density, slow outflow expansion driven by solar EUV heating by N_2 absorption, near-IR and UV heating by CH_4 absorption, and CO cooling by rotational line emission as a function of solar activity. At 30 AU, the N_2 escape rate varies from $(4-6.4)\times10^{26}$ molecules s^{-1} in the absence of heating, but driven by an upward thermal heat conduction flux from the stratosphere, for lower boundary temperatures varying from 70–100 K. With solar heating varying from solar minimum to solar maximum conditions and a calculated lower boundary temperature, 88.2 K, the N_2 escape rate range is $(1.8-6.7)\times10^{27}$ molecules s^{-1}, respectively. LTE rotational line emission by CO reduces the net solar heat input by at most 35% and plays a minor role in lowering the calculated escape rates, but ensures that the lower boundary temperature can be calculated by radiative equilibrium with near-IR CH_4 heating. While an upward thermal conduction heat flux at the lower boundary plays a fundamental role in the absence of heating, with solar heating it is downward at solar minimum, and is, at most, 13% of the integrated net heating rate over the range of solar activity. For the arrival of the New Horizons spacecraft at Pluto in July 2015, predictions are lower boundary temperature, $T_0 \sim 81$ K, and N_2 escape rate $\sim 2.2 \times 10^{27}$ molecules s^{-1}, and peak thermospheric temperature ~ 103 K at 1890 km, based on expected solar medium conditions.

Published in: Icarus, 193, 612 (2008 February)

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Polarimetry of the Dwarf Planet (136199) Eris

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Context. We study the surface properties of the transneptunian population of Solar-system bodies.

Aims. We investigate the surface characteristics of the large dwarf planet (136199) Eris.

Methods. With the FORS1 instrument of the ESO Very Large Telescope, we have obtained Bessell broadband R linear polarimetry and broadband V and I photometry of Eris. We have modelled the observations in terms of the coherent-backscattering mechanism to constrain the surface properties of the object.

Results. Polarimetric observations of Eris show a small negative linear polarization without opposition surge in the phase angle range of $0.15^\circ - 0.5^\circ$. The photometric data allow us to assume a brightness opposition peak at phase angles below $0.2^\circ - 0.3^\circ$. The data obtained suggest a possible similarity to the polarimetric and photometric phase curves of Pluto. The measured absolute magnitude and broadband colors of Eris are $H_V = -1.15$ mag, $V-R = 0.41$ mag, and $V-I = 0.75$ mag.

Conclusions. The observational data with theoretical modelling are in agreement with the surface of Eris being covered by large inhomogeneous particles.

Published in: Astronomy & Astrophysics, 479, 265, (2008 February)

Preprints on the web at `http://arxiv.org/abs/0711.4974`

PAPERS RECENTLY SUBMITTED TO JOURNALS

The Scattered Disk as the Source of the Jupiter Family Comets

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Submitted to: The Astrophysical Journal

For preprints, contact kvolk@lpl.arizona.edu

or on the web at http://arxiv.org/abs/0802.3913

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

Hilke E. Schlichting[1] **and Re'em Sari**[1,2]

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Submitted to: 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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Study of the Surface of 2003 EL_{61}: The Largest Carbon-depleted Object in the Trans-neptunian Belt

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Submitted to: Astronomy & Astrophysics

Preprint available at: http://arxiv.org/abs/0803.1080

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On the Origin of Pluto's Minor Moons, Nix and Hydra

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Submitted to: The Astrophysical Journal

Preprints on the web at http://arxiv.org/abs/0802.2951

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The Effect of Charon's Tidal Damping on the Orbits of Pluto's Three Moons

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Submitted to: The Astrophysical Journal

Preprints on the web at http://arxiv.org/abs/0802.2939

The Taiwanese-American Occultation Survey: The Multi-Telescope Robotic Observatory

M.J. Lehner[1,2], C.-Y. Wen[1], J.-H. Wang[1], S.L. Marshall[3,4], M.E. Schwamb[5], Z.-W. Zhang[6], F.B. Bianco[7,2], J. Giammarco[8], R. Porrata[9], C. Alcock[2], T. Axelrod[10], Y.-I. Byun[11], W.P. Chen[5], K.H. Cook[4], R. Dave[12], S.-K. King[1], T. Lee[1], H.-C. Lin[5], and S.-Y. Wang[1]

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Submitted to: Publication of the Astronomical Society of the Pacific

Preprints available on the web at `http://arxiv.org/abs/0802.0303`

OTHER PAPERS OF INTEREST

Temperatures of Aqueous Alteration and Evidence for Methane Generation on the Parent Bodies of the CM Chondrites

Weifu Guo[1] and John M. Eiler[1]

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Geochimica et Cosmochimica Acta, 71, 5565 (2007 November)

The Impact of the Kuiper Belt Objects and of the Asteroid Ring on Future High-precision Relativistic Solar System Tests

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Published in: Planetary and Space Science, 55, 1045 (November 2007)

Preprints on the web at `http://arxiv.org/abs/gr-qc/0703017`

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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`ekonews@boulder.swri.edu`