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DISTANT EKOs

The Kuiper Belt Electronic Newsletter

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CONTENTS

NEWS & ANNOUNCEMENTS

Previously, the policy of *Distant EKOs* was, for those papers that had been submitted to journals but not yet accepted, to publish them in the newsletter as "title only" (with author list and link to preprints). Starting with this issue, I am changing the policy of the newsletter so that full abstracts will be published for papers submitted to refereed publications.

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The Herschel "TNOs are cool" program (photometry of 130 TNOs at thermal wavelengths) is now virtually finished. Results (observing circumstances, fluxes, radiometric solutions) can be found at:
`http://public-tnosarecool.lesia.obspm.fr/`

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There were 11 new TNO discoveries announced since the previous issue of *Distant EKOs*:

2006 SE415, 2006 SF415, 2007 FM51, 2007 RW326, 2007 RX326, 2007 RY326,
2014 MT69, 2014 MU69, 2014 OS393, 2014 PN70, 2015 FP36

and 6 new Centaur/SDO discoveries:

2007 FN51, 2007 LE38, 2007 LF38, 2008 JO41, 2015 DB216, 2015 FZ117

Reclassified objects:
2015 DB216 (SDO → Centaur)

Objects recently assigned numbers:
2015 BQ311 = (433873)
2012 HH2 = (432949)

Current number of TNOs: 1365 (including Pluto)
Current number of Centaurs/SDOs: 441
Current number of Neptune Trojans: 12

Out of a total of 1818 objects:
669 have measurements from only one opposition
637 of those have had no measurements for more than a year
329 of those have arcs shorter than 10 days
(for more details, see: `http://www.boulder.swri.edu/ekonews/objects/recov_stats.jpg`)

PAPERS ACCEPTED TO JOURNALS

Growth of Asteroids, Planetary Embryos and Kuiper Belt Objects by Chondrule Accretion

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Chondrules are millimeter-sized spherules that dominate primitive meteorites (chondrites) originating from the asteroid belt. The incorporation of chondrules into asteroidal bodies must be an important step in planet formation, but the mechanism is not understood. We show that the main growth of asteroids can result from gas-drag-assisted accretion of chondrules. The largest planetesimals of a population with a characteristic radius of 100 km undergo run-away accretion of chondrules within ∼3 Myr, forming planetary embryos up to Mars sizes along with smaller asteroids whose size distribution matches that of main belt asteroids. The aerodynamical accretion leads to size-sorting of chondrules consistent with chondrites. Accretion of mm-sized chondrules and ice particles drives the growth of planetesimals beyond the ice line as well, but the growth time increases above the disk life time outside of 25 AU. The contribution of direct planetesimal accretion to the growth of both asteroids and Kuiper belt objects is minor. In contrast, planetesimal accretion and chondrule accretion play more equal roles for the formation of Moon-sized embryos in the terrestrial planet formation region. These embryos are isolated from each other and accrete planetesimals only at a low rate. However, the continued accretion of chondrules destabilizes the oligarchic configuration and leads to the formation of Mars-sized embryos and terrestrial planets by a combination of direct chondrule accretion and giant impacts.

To appear in: Science Advances

Preprints available on the web at `http://arxiv.org/abs/1503.07347`

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Pushing the Limits: K2 Observations of the Trans-Neptunian Objects 2002 GV_{31} and (278361) 2007 JJ_{43}

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We present the first photometric observations of trans-Neptunian objects (TNOs) taken with the *Kepler* space telescope, obtained in the course of the K2 ecliptic survey. Two faint objects have been monitored in specifically designed pixel masks that were centered on the stationary points of

the objects, when their daily motion was the slowest. In the design of the experiment, only the apparent path of these objects were retrieved from the detectors, i.e. the costs in terms of Kepler pixels were minimized. Because of the faintness of the targets we employ specific reduction techniques and co-added images. We measure rotational periods and amplitudes in the unfiltered *Kepler* band as follows: for (278361) 2007 JJ_{43} and 2002 GV_{31} we get $P_{rot} = 12.097$ h and $P_{rot} = 29.2$ h while 0.10 and 0.35 mag for the total amplitudes, respectively. Future space missions, like TESS and PLATO are not well suited to this kind of observations. Therefore, we encourage to include the brightest TNOs around their stationary points in each observing campaign to exploit this unique capability of the K2 Mission – and therefore to provide unbiased rotational, shape and albedo characteristics of many objects.

To appear in: The Astrophysical Journal Letters
For preprints, contact apal@szofi.net
or on the web at http://arxiv.org/abs/1504.03671
and http://szofi.net/apal/astro/k2/tno/

PAPERS RECENTLY SUBMITTED TO JOURNALS

Volatile Loss and Classification of Kuiper Belt Objects

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Observations indicate that some of the largest Kuiper Belt Objects (KBOs) have retained volatiles in the gas phase, which implies the presence of an atmosphere that can affect their reflectance spectra and thermal balance. Volatile escape rates driven by solar heating of the surface were estimated by Schaller and Brown (2007) (SB) and Levi and Podolak (2009) (LP) using Jeans escape from the surface and a hydrodynamic model respectively. Based on recent molecular kinetic simulations these rates can be hugely in error (e.g., a factor of $\sim 10^{16}$ for the SB estimate for Pluto). In this paper we estimate the loss of primordial N_2 for several large KBOs guided by recent molecular kinetic simulations of escape due to solar heating of the surface and due to UV/EUV heating of the upper atmosphere. For the latter we extrapolate simulations of escape from Pluto (Erwin et al. 2013) using the energy limited escape model recently validated for the KBOs of interest by molecular kinetic simulations (Johnson et al. 2013). Unless the N_2 atmosphere is thin ($\lesssim 10^{18}$ N_2/cm^2) and/or the radius is small ($\lesssim$ 200–300 km), we find that escape is primarily driven by the UV/EUV radiation absorbed in the upper atmosphere rather than the solar heating of the surface. This affects the previous interpretations of the relationship between atmospheric loss and the observed surface properties. The long-term goal is to connect detailed atmospheric loss simulations with a model for volatile transport (e.g., Young, 2014) for individual KBOs.

Submitted to: The Astrophysical Journal

For preprints, contact `apurva.oza@latmos.ipsl.fr`
or on the web at `http://arxiv.org/abs/1503.05315`

OTHER PAPERS OF INTEREST

Proposed Nomenclature for Surface Features on Pluto and Its Satellites and Names for Newly Discovered Satellites

Eric E. Mamajek[1] Valerie A. Rapson[2], David A. Cameron[1], Manuel Olmedo[1,3], Shane Fogerty[1], Eric Franklin[1], Erini Lambrides[4], Imran Hasan[5], Richard E. Sarkis[1], Stephen Thorndike[6], and Jason Nordhaus[2,7,8]

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This is a white paper, available on the web at `http://arxiv.org/abs/1503.07947v1`

CONFERENCE CONTRIBUTIONS

The Dynamics of Centaurs in the Vicinity of the 2:1 Mean Motion Resonance of Neptune and Uranus Trojan Region

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In this work we present the results of a suite of dynamical simulations following the orbital evolution of 8,022 hypothetical Centaur objects. These Centaurs begin our integrations on orbits in the vicinity of the 2:1 mean motion resonance with Neptune, and we follow their dynamical evolution for a period of 3 Myr under the gravitational influence of a motionless Sun and the four Jovian planets. The great majority of the test particles studied rapidly escaped from the vicinity of the 2:1 mean motion resonance of Neptune and diffused throughout the Solar System. The average libration time of Centaurs in the vicinity of 2:1 mean motion resonance of Neptune was found to be just 27 kyr. Although two particles did remain near the resonance for more than 1 Myr. Upon leaving the vicinity of the 2:1 resonance, the majority of test particles evolved by a process of random walk in semi-major axis, due to repeated close encounters with the giant planets.

To appear in: Proceedings of the 14th Annual Australian Space Research Conference
Preprints available or on the web at `http://arxiv.org/abs/1503.06096`

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 papers submitted, in press, or recently published in refereed journals
⋆ Titles of conference presentations
⋆ 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.

Distant EKOs is not a refereed publication, but is a tool for furthering communication among people interested in Kuiper belt research. Publication or listing of an article in the newsletter or the web page does not constitute an endorsement of the article's results or imply validity of its contents. When referencing an article, please reference the original source; *Distant EKOs* is not a substitute for peer-reviewed journals.

Moving ... ??

If you move or your e-mail address changes, please send the editor your new address. If the newsletter bounces back from an address for three consecutive issues, the address will be deleted from the mailing list. All address changes, submissions, and other correspondence should be sent to:

`ekonews@boulder.swri.edu`