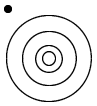
Issue No. 19 *September 2001*

DISTANT EKOs



The Kuiper Belt Electronic Newsletter

Edited by: Joel Wm. Parker

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CONTENTS

NEWS & ANNOUNCEMENTS

As was done with Varuna, 2001 KX76 has been found in archival images. The seven oppositions dating back to 1982 give it a low enough orbital uncertainty to qualify it for numbering. Its absolute magnitude ($H = 3.2$) is now also brighter based on those and new observations, giving an estimated diameter of 1200 to 1400 km and making it now the largest minor planet, bigger than Ceres or Charon. See M.P.E.C. 2001-P28:

`http://cfa-www.harvard.edu/mpec/K01/K01P28.html`

and story at

`http://www.cnn.com/2001/TECH/space/08/24/minor.planet/index.html`
`http://www.eso.org/outreach/press-rel/pr-2001/phot-27-01.html`

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F. Marchis and J. Berthier have calculated appulse events which involve bright stars from Tycho-2 catalogue ($m_V < 14$ mag) and TNOs or Centaurs. They provide a web page describing the work and listing the events: `http://astron.berkeley.edu/~fmarchis/Science/TNOs_Appulse/`

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There were 17 new TNO discoveries announced since the previous issue of the *Distant EKOs* Newsletter:

2000 SW370, 2000 SX370, 2000 SY370, 2000 YY142, 2001 OJ108, 2001 OK108, 2001 OL108, 2001 OM108, 2001 ON108, 2001 OO108, 2001 OQ108, 2001 OR108, 2001 OS108, 2001 OU108, 2001 OY108, 2001 OZ108, 2001 PK47

and 2 new Centaur/SDO discoveries:

2001 OT108, 2001 PT13

Reclassified objects:
2000 PL30 (TNO $\rightarrow$ SDO)
2000 PJ30 (TNO $\rightarrow$ SDO)
2000 OB51 (SDO $\rightarrow$ TNO)
2001 KD77 (SDO $\rightarrow$ TNO)

Object with new identification:
2000 PJ30 = 1999 OO4

Objects recently assigned numbers:
2001 KX76 (28978)

Current number of TNOs: 431 (and Pluto & Charon)
Current number of Centaurs/SDOs: 79

EDITORIALS & SHORT ARTICLES

The *Distant EKOs* Newsletter and webpage celebrate their third anniversary this month. The newsletter has 348 subscribers from 31 countries, and the web page has had over 11,200 hits.

There were many reasons for me to start this newsletter, including wanting to have some format that I and others would find useful for quickly communicating recent results in Kuiper belt research. I hope most of you have found it meets that goal. If you have any suggestions for changes and improvements, please let me know.

Another part of my initial motivation for starting this newsletter was to provide a conduit for observers to collaborate in discovery, recovery, and physical observation programs. In the nine years from the discovery of the first TNO (not counting Pluto and Charon), we have discovered as many objects in the Kuiper belt as it took 100 years to discover in the main asteroid belt. No doubt that number will double in much less than another nine years, and hopefully recovery efforts will be given enough priority so that the biases that are finally being recognized as resulting from lost objects will be minimized.

The administration of *Distant EKOs* has been exclusively a one-man show. However, as the numbers of objects and papers have increased, so has the time commitment to keep the newsletter running and the web pages current. Much of the web page content is updated automatically, but some aspects require manual upkeep. Because of time and funding limitations, I have not been able to keep all the web pages current, and I know that many people have found those pages useful since I get e-mails pointing out that some references or observations are not listed on the pages. So, I am looking for someone to help me with the web pages, particularly in keeping the lists of published observations and references up-to-date:

`http://www.boulder.swri.edu/ekonews/objects/tabobs.html`

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

If you are interested in helping and can work with HTML and IDL or Perl, please contact me at: `joel@boulder.swri.edu`

I thank all the subscribers and contributors for your feedback and support.

Joel Parker

PAPERS ACCEPTED TO JOURNALS

The Structure of the Kuiper Belt: Size Distribution and Radial Extent

Brett Gladman[1], J.J. Kavelaars[2], Jean-Marc Petit[1], Alessandro Morbidelli[1], Matthew J. Holman[3], and T. Loredo[4]

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The size distribution in the Kuiper Belt records physical processes operating during the formation and subsequent evolution of the solar system. This paper reports a study of the apparent magnitude distribution of faint objects in the Kuiper Belt, obtained via deep imaging on the Canada-France-Hawaii Telescope and the ESO Very Large Telescope UT1. We find that the entire range of observed objects (magnitudes $m_R \sim 20-27$) is well represented by an unbroken power law, with the number of objects per square degree brighter than magnitude R being of the form $\Sigma(m_R < R) = 10^{\alpha(R-R_0)}$, with $\alpha = 0.69$ and $R_0 = 23.5$. This luminosity function's slope implies a steep size distribution in the observed range, which should "roll over" to a shallower "collisional" slope once observations extend to even fainter magnitudes and thus sample bodies whose collisional ages become less than the age of the solar system. Our observations indicate the roll over is for diameters of less than 50 km, in agreement with collisional models. Modeling our survey gives a belt mass between 30 and 50 AU of order $0.1 M_\odot$, relatively insensitive to the roll over diameter as long as the latter is ≤ 1 km. We report the discovery of several objects outside of 48 AU and discuss the evidence for a sharp outer edge to the trans-Neptunian distribution.

Published in: Astronomical Journal 122, 1051 (2001 August)
For preprints, contact gladman@obs-nice.fr

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The Scattered Trans-Neptunian Object 1998 XY95

S.J. Collander-Brown[1], A. Fitzsimmons[1], E. Fletcher[1] M.J. Irwin[2], and I.P. Williams[3]

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On 1998 December 12 a new Trans-Neptunian object, 1998 XY95, was discovered as part of a deep search. Recent observations of this object have placed it amongst the class of objects known as the scattered Trans-Neptunian Objects (TNOs). A total of 39 CCD images of 1998 XY95 were taken over two nights and these were used to search for a light curve, but no significant periodicity was found. An examination of the possible orbital evolution gives no indication of how it may have arrived on its present orbit. The current best fit orbit is unstable, but remains with in a band of semi-major axis approximately 2 AU wide. The bottom of this band is due to 3:1 mean motion resonance with Neptune, while the reason for the top of the band remains unclear.

Published in: Monthly Notices of the Royal Astronomical Society, 325, 972
For preprints, contact S.C.Brown@qub.ac.uk

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Large Bodies in the Kuiper Belt

C.A. Trujillo[1], J.X. Luu[2], A.S. Bosh[3], and J.L. Elliot[4]

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[2] Leiden Observatory, PO Box 9513, 2300 RA Leiden, The Netherlands

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[4] Department of Earth, Atmospheric, and Planetary Sciences and Department of Physics, Massachusetts Institute of Technology, Cambridge, MA 02139; and Lowell Observatory, Flagstaff, AZ 86001, USA

We present a survey for bright Kuiper Belt Objects (KBOs) and Centaurs, conducted at the Kitt Peak National Observatory (KPNO) 0.9 m telescope with the KPNO 8k Mosaic CCD. The survey imaged 164 sq deg near opposition to a limiting red magnitude of 21.1. Three bright KBOs and one Centaur were found, the brightest KBO having red magnitude 19.7, about 700 km in diameter assuming a dark Centaur-like 4% albedo. We estimate the power-law differential size distribution of the Classical KBOs to have index $q = 4.2^{+0.4}_{-0.3}$, with the total number of Classical KBOs with diameters larger than 100 km equal to $4.7^{+1.6}_{-1.0} \times 10^4$. Additionally, we find that if there is a maximum object size in the Kuiper Belt, it must be larger than 1000 km in diameter. By extending our model to larger size bodies, we estimate that 30^{+16}_{-12} Charon-sized and $3.2^{+2.8}_{-1.7}$ Pluto-sized Classical KBOs remain undiscovered.

To appear in: Astronomical Journal (2001 November)
For preprints, contact `chad@gps.caltech.edu`
or by anonymous ftp to `ftp://ftp.gps.caltech.edu/pub/chad/large-bodies.ps`
or on the web at `http://xxx.lanl.gov/ps/astro-ph/0108428`

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Cometary Activity in 2060 Chiron at Minimum Brightness

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We present two-colour CCD imaging of 2060 Chiron obtained between 1996 and 1998 with the 2.15 m telescope at CASLEO (San Juan, Argentina). These post-perihelion observations show that Chiron was then near its historical brightness minima, however a coma was clearly detected. The dynamical state of the coma is studied by means of azimuthally averaged surface brightness profiles, which show the signatures of radiation pressure on the dust grain distribution. Aperture photometry shows an achromatic dimming with an amplitude ≈ 0.09 mag in approximately one hour. If due to rotation of the nucleus, this rather high amplitude is used to derive a new value for the nuclear magnitude, $m_0 \approx 6.80$ mag.

To appear in: Planetary & Space Science
For preprints, contact `scellone@fcaglp.unlp.edu.ar`
or on the web at `http://arXiv.org/abs/astro-ph/0107317`

OTHER PAPERS OF INTEREST

Deficiency of Molecular Hydrogen in the Disk of β Pictoris

A. Lecavelier Des Etangs[1], A. Vidal-Madjar[1], A. Roberge[2], P.D. Feldman[2], M. Deleuil[3], M. André[2], W.P. Blair[2], J.-C. Bouret[3], J.-M. Désert[1], R. Ferlet[1], S. Friedman[2], G. Hébrard[1], M. Lemoine[1], and H.W. Moos[2]

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Molecular hydrogen (H_2) is by far the most abundant material from which stars, protoplanetary disks and giant planets form, but it is difficult to detect directly. Infrared emission lines from H_2 have recently been reported towards β Pictoris, a star harbouring a young planetary system. This star is surrounded by a dusty 'debris disk' that is continuously replenished either by collisions between asteroidal objects or by evaporation of ices on Chiron-like objects. A gaseous disk has also been inferred from absorption lines in the stellar spectrum. Here we present the far-ultraviolet spectrum of β Pictoris, in which H_2 absorption lines are not seen. This allows us to set a very low upper limit on the column density of H_2 : $N(H_2) \leq 10^{18}\ cm^{-2}$. This non-detection is puzzling when compared to the quantity of H_2 inferred from the infrared observations, but it does show that H_2 is not in the disk on the direct line of sight. Carbon monoxide (CO) has been seen in absorption against the star, yielding a ratio of $CO/H_2 > 6 \times 10^{-4}$. As CO would be destroyed under ambient conditions in about 200 years, our result demonstrates that the CO in the disk arises from evaporation of planetesimals.

Published in: Nature, 412, 706 (2001 August 16)
For reprints, contact `lecaveli@iap.fr)`

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Photometric and Spectroscopic Observations of Sycorax, Satellite of Uranus

J. Romon[1], C. de Bergh[1], M.A. Barucci[1], A. Doressoundiram[1], J.-G. Cuby[2], A. Le Bras[1,3], S. Dout[4], and B. Schmitt[4]

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[2] ESO, Chile

[3] IAS, Orsay, France

[4] Lab. de Plantologie de Grenoble, St Martin d'Hres, France

Sycorax is the brightest of the five irregular Uranian satellites recently discovered. These satellites are supposed to be captured bodies. We present visible and near-infrared photometry, as well as near-infrared spectroscopy of Sycorax. The overall shape of the spectrum is quite puzzling: it has a red slope in the visible (such as Centaurs and Transneptunian objects), whereas the reflectivity strongly decreases beyond 1 μm and is rather flat over the near-infrared range. We were not able to reproduce the spectral behaviour of Sycorax using simple materials. A rotational effect is suggested to explain the shape of the spectrum. $BVRIJ$ magnitudes have been measured over a period of

1 hour, with five V measurements which do not show any strong variation. So only a strong change in the magnitude between the V measurements and the J measurement (30 min later) could explain the shape of the spectrum, but further investigation is required to conclude.

Published in: Astronomy & Astrophysics, 376, 310 (2001 September)
For reprints, contact jennifer.romon@obspm.fr
or on the web at
http://www.edpsciences-usa.org/articles/aa/abs/2001/34/aah2865/aah2865.html

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BOOKS

Beyond Pluto: Exploring the Outer Limits of the Solar System

John Davies[1]
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Here is the publishers blurb about the book. Many readers of EKO news helped to write it and have already seen sample chapters. For more info, contact John directly.

In the last ten years, the solar system has more than doubled in size. For the first time in almost two centuries an entirely new population of planetary objects has been found. This Kuiper Belt of minor planets beyond Neptune has revolutionised our understanding of how the solar system was formed and has finally explained the origin of the enigmatic outer planet Pluto. This is the fascinating story of how theoretical physicists decided that there must be a population of unknown bodies beyond Neptune and how a small band of astronomers set out to find them. What they discovered was a family of ancient planetesimals whose orbits and physical properties were far more complicated than anyone expected. We follow the story of this discovery, and see how astronomers, theoretical physicists and one incredibly dedicated amateur observer have come together to explore the frozen boundary of the solar system.

Contents

Published in: Cambridge University Press
Author contact J.Davies@roe.ac.uk
Available on the web at http://uk.cambridge.org/popsci/catalogue/0521800196/

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.

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`