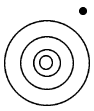
Issue No. 5 *May 1999*

DISTANT EKOs



The Kuiper Belt Electronic Newsletter

Edited by: Joel Wm. Parker

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

CONTENTS

NEWS & ANNOUNCEMENTS

As another public service (and, stealing an idea from another electronic newsletter), if you move your working address and wish to advertise this to the Kuiper belt community, send an e-mail to me with your new address/phone/e-mail information and it will be included in a subsequent issue.

. . . . . .

Kuiper belt objects are habitats for intelligent extraterrestrial beings?
`http://www.accessnv.com/nids/GMatloff_essay.shtml`.

. . . . . .

Two more Centaurs have been numbered, bringing the total up to six out of nine Centaurs that have orbits determined well enough to be given number designations:

(2060)	1977 UB	= Chiron
(5145)	1992 AD	= Pholus
(7066)	1993 HA2	= Nessus
(8405)	1995 GO	
(10199)	1997 CU26	
(10370)	1995 DW2	

. . . . . .

There were 35 new EKO discoveries announced since the previous issue of the *Distant EKOs* Newsletter:

1998 HH151, 1998 VG44 (objects from old observations continue to trickle in...),
1999 CB119, 1999 CC119, 1999 CD119, 1999 CE119, 1999 CF119, 1999 CG119,
1999 CH119, 1999 CJ119, 1999 CK119, 1999 CL119, 1999 CM119, 1999 CN119,
1999 CW131, 1999 CX131, 1999 CY131, 1999 CA132, 1999 CZ131, 1999 CP133,
1999 CQ133, 1999 CR133, 1999 CM153, 1999 CN153, 1999 CO153, 1999 CP153,
1999 CQ153, 1999 CR153, 1999 CS153, 1999 CT153, 1999 CU153, 1999 CG154,
1999 CH154, 1999 DA8, 1999 DZ7,

Object 1999 CE119 is an assumed perihelic 4:5 Neptune librator.
Objects 1998 HH151, 1999 DA and 1999 DZ7 are assumed to be in the 2:3 resonance with Neptune, and 1999 DA has an inclination of 40 degrees.

As of mid-March, the number of EKOs discovered in 1999 surpassed the number discovered/reported in 1998, which had been most productive year for discoveries.

Current number of EKOs: 136 (and Pluto & Charon)
Current number of Centaurs: 9

PAPERS ACCEPTED TO JOURNALS

Compositional Surface Variety among The Centaurs

M. A. Barucci[1], M. Lazzarin[2], and G. P. Tozzi[3]

[1] Observatoire de Paris Meudon, Place Jules Janssen 5, F-92195 Meudon Cedex, France

[2] Dipartimento di Astronomia, Università di Padova, vicolo dell'Osservatorio 5, I-35122 Padova, Italy

[3] Osservatorio Astrofisico di Arcetri, Largo Enrico Fermi 5, I-50125 Firenze, Italy

The Centaurs are a particular family of objects with orbits whose semimajor axes fall between those of Jupiter and Neptune. They are likely the transition objects between the Kuiper belt population and short-period comets. To investigate the nature of these particular objects, we have performed optical spectroscopic observations of five Centaurs. The results show a great diversity among the reflectances of the five Centaurs. The colors do not seem to be related to the perihelion distance of the objects. We looked for weak cometary emission features, in particular the CN-band emission at 3880Å, but no CN emission feature has been detected within 3 in any of the investigated spectra.

Published in: The Astrophysical Journal, 117, 1929
For reprints, contact barucci@obspm.fr

. . . . . .

Optical and infrared observations of the Centaur 1997 CU_{26}

N. McBride[1], J.K. Davies[2], S.F. Green[1] and M.J. Foster[1]

[1] Unit for Space Sciences & Astrophysics, The Physics Laboratory, University of Kent, Canterbury, CT2 7NR, UK

[2] Joint Astronomy Centre, 660 N A'ohoku Pl., Hilo, Hawaii, 96720, USA

Minor Planet 1997 CU_{26} is a Centaur, and is probably undergoing dynamical evolution inwards from the Kuiper Belt. We present optical and infrared (VRIJHK) photometry which give mean colours of V−R=0.46±0.02, V−I=1.02±0.02, V−J=1.74±0.02, V−H=2.15±0.02, and V−K=2.25±0.02. The resulting relative reflectance spectrum lies between those of Chiron and Pholus (although closer to Chiron). A 1.6 μm–2.6 μm spectrum confirms the broad absorption feature at 2.05 μm associated with water ice reported by Brown *et al.* (1998). 1997 CU_{26} displays no significant lightcurve variation and (unlike Chiron) has no observable coma. We place an upper limit to the dust production rate of 1.5 kg s^{-1}. J band data taken at phase angles 1.7° to 4.0° give a phase parameter of G_J=0.36±0.1, and are consistent with a phase parameter of G=0.15 in the V band (a value often assigned to low albedo objects when no other information is available) if we assume a phase reddening of 0.017 mag deg^{-1} in the J band. We find V(1,α=4.1°)=7.022±0.02 from which we deduce, by assuming G=0.15±0.1, an absolute visual magnitude of H_V=6.64±0.04.

To appear in: Monthly Notices of the Royal Astronomical Society
For preprints, contact N.McBride@ukc.ac.uk

. . . . . .

Signatures of the Giant Planets Imprinted on the Edgeworth-Kuiper Belt Dust Disk

J.-C. Liou[1] **and H.A. Zook**[2]

[1] GB Tech/Lockheed Martin

[2] NASA Johnson Space Center

One method to detect extrasolar planetary systems is to deduce the perturbations of planets on the observed circumstellar dust disks. Our Solar System, with its known configuration of planets, provides an excellent example to study how the distribution of dust in the Edgeworth-Kuiper Belt (EKB) dust disk is affected by the existence of multiple-and-different planets. Numerical simulations of the orbital evolution of dust particles from EKB objects show that Neptune, by trapping dust particles in mean motion resonances (MMRs), creates a ring-like structure along its orbit. Jupiter and Saturn, by ejecting dust particles from the Solar System, create a radial brightness profile inside 10 AU that is quite different from that of a dust disk without their perturbations. On the other hand, Uranus and terrestrial planets do not produce significant signatures on the EKB dust disk. Our Solar System would be recognized as a system with at least two planets when observed from afar.

To appear in: The Astronomical Journal (July 1999)
For preprints, contact `jer-chyi.liou1@jsc.nasa.gov`

. . . . . .

Accretion in the Early Kuiper Belt II. Fragmentation

Scott J. Kenyon[1] **and Jane X. Luu**[2]

[1] Harvard-Smithsonian Center for Astrophysics, 60 Garden St, Cambridge, MA 02138, USA

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

We describe new planetesimal accretion calculations in the Kuiper Belt that include fragmentation and velocity evolution. All models produce two power law cumulative size distributions, $N_C \propto r^{-2.5}$ for radii $\lesssim$ 0.3–3 km and $N_C \propto r^{-3}$ for radii $\gtrsim$ 1–3 km. The power law indices are nearly independent of the initial mass in the annulus M_0; the initial eccentricity of the planetesimal swarm e_0; and the initial size distribution of the planetesimal swarm. The transition between the two power laws moves to larger radii as e_0 increases. The maximum size of objects depends on the intrinsic tensile strength S_0; Pluto formation requires $S_0 \gtrsim 300$ erg g^{-1}. The timescale to produce Pluto-sized objects τ_P is roughly proportional to M_0^{-1} and e_0, and is less sensitive to other input parameters. Our models yield $\tau_P \approx$ 30–40 Myr for planetesimals with $e_0 = 10^{-3}$ in a minimum mass solar nebula. The production of several 'Plutos' and $\sim 10^5$ 50 km radius Kuiper Belt objects leaves most of the initial mass in 0.1–10 km radius objects that can be collisionally depleted over the age of the solar system. These results resolve the puzzle of large Kuiper Belt objects in a small mass Kuiper Belt.

To appear in: The Astronomical Journal (July 1999)
Preprints on the web at `http://cfa-www.harvard.edu/~kenyon/preprints.html`

. . . . . .

Large Scattered Planetesimals and the Excitation of the Small Body Belts

J-M. Petit[1], A. Morbidelli[1], and G.B. Valsecchi[2]

[1] Centre National de la Recherche Scientifique, Observatoire de Nice, B.P. 4229, 06304 Nice Cedex 4, France

[2] IAS - Planetologia, Area di Ricerca del C.N.R., Via Fosso del Cavaliere, 00133 Roma, Italy

We study the dynamical excitation that large planetesimals, scattered either by Neptune or Jupiter, could have provided to the primordial Edgeworth-Kuiper belt and the asteroid belt. Using both a refined Monte Carlo approach and direct numerical integrations, we show that the Monte Carlo method is useful only to give a qualitative insight on the resulting excitation, but cannot be trusted from a quantitative view point. According to our direct integrations, Neptune-scattered planetesimals of mass from few tenths to one Earth mass could have ejected most of the bodies from the primordial Edgeworth-Kuiper belt, thus explaining the large mass deficiency of the present belt up to about 50 AU. The remaining bodies are left on orbits with eccentricity and inclination comparable to those observed. This dynamical excitation is not restricted to the inner part of the belt but may extend to 100 AU. We also show that Pluto has too small a mass to destabilize the motion of other bodies in the 2:3 mean motion resonance with Neptune. The same mechanism involving Jupiter scattered planetesimals of about one Earth mass can excite the outer asteroid belt, hence depleting it of most of its primordial mass. However this fails to excite the inner belt. In the case where the planetesimals are isolated by mutual gravitational perturbations on long lived main belt-like orbits, safe from Jupiter's encounters, the resulting asteroid belt is very similar to the presently observed one, in terms of mass deficiency, excitation in eccentricity and inclination, and radial mixing. Pallas-like bodies are also obtained. However the decoupling of planetesimals from Jupiter on well behaved orbits is rather improbable (2% of our simulations), and the resulting asteroid belt is very critically dependent on the mass of the scattered planetesimals and their residence time in the belt.

To appear in: Icarus

For preprints, contact `petit@obs-nice.fr`

or on the web at `http://www.obs-nice.fr/petit/Preprints/PAPERS.html`

. . . . . .

Kuiper Belt Evolution due to Dynamical Friction

A. Del Popolo[1,2], E. Spedicato[2], and M. Gambera[1,3]

[1] Istituto di Astronomia dell'Università di Catania, Viale A.Doria, 6 - I 95125 Catania, ITALY

[2] Dipartimento di Matematica, Università Statale di Bergamo, Piazza Rosate, 2 - I 24129 Bergamo, ITALY

[3] Osservatorio Astrofisico di Catania and CNR-GNA, Viale A.Doria, 6 - I 95125 Catania, ITALY

In this paper we study the role of dynamical friction on the evolution of a population of large objects ($m > 10^{22}$ g) at heliocentric distances > 70 AU in the Kuiper Belt. We show that the already flat distribution of these objects must flatten further due to non-spherically symmetric distribution of matter in the Kuiper Belt. Moreover the dynamical drag, produced by dynamical friction, causes objects of masses $\geq 10^{24} g$ to lose angular momentum and to fall through more central regions in a timescale $\approx 10^9$ yr. This mechanism is able to transport inwards objects of the size of Pluto, supposing it was created beyond 50 AU, according to a Stern & Colwell's (1997b) suggestion.

To appear in: Astronomy & Astrophysics

For preprints, contact `adelpopolo@alpha4.ct.astro.it`

or on the web at `http://xxx.lanl.gov/abs/astro-ph/9905014`

PAPERS RECENTLY SUBMITTED TO JOURNALS

Keck Pencil-beam Survey for Faint Kuiper Belt Objects

E. I. Chiang[1] and M. E. Brown[1]

[1] California Institute of Technology

Submitted to: the Astronomical Journal

For preprints, contact `echiang@tapir.caltech.edu`

or on the web at `www.its.caltech.edu/~eugene/ppp/ppp.html`

. . . . . .

The Dynamics of Plutinos

Qingjuan Yu[1] and Scott Tremaine[1]

[1]Princeton University Observatory, Peyton Hall, Princeton, NJ 08544-1001, USA

Submitted to: The Astronomical Journal

For preprints, on the web at `http://xxx.lanl.gov/ps/astro-ph/9904424`

CONFERENCE INFORMATION

The Solar System and Planetary Debris Disks: Prospects for SIRTF

1999 August 18–20
San Juan Capistrano, California, USA

`http://www.sji.org`

This 2.5-day event will focus on the capabilities of the Space Infrared Telescope Facility (SIRTF) for Solar System studies, and for observations of planetary debris disks. It will be a working session organized to let the user community communicate their needs to the SIRTF Project engineers and scientists, and to provide information about the facility capabilities to the users. Among the goals of the workshop are 1) to inspire planetary scientists to develop proposals for observing with SIRTF and give them the information and tools to do so, 2) to bring the debris disk community into contact with planetary scientists for the development of collaborative and symbiotic observational strategies, and 3) to provide an atmosphere in which team proposals can be conceived. Attendance is limited to about 110 participants. Dale Cruikshank (`dale@ssa1.arc.nasa.gov`) and Martha Hanner (`msh@scn1.jpl.nasa.gov`) are co-chairs.

The San Juan Institute web page (`http://www.sji.org`) describes the workshop and has the program, although not all speakers and session chairs have yet been confirmed. The SIRTF web page (`http://ssc.ipac.caltech.edu/SIRTF`) describes the mission, with technical details on the telescope and the three instruments. SIRTF is scheduled for launch in December 2001 for a mission duration of at least 2.5 years.

For future mailings about the workshop, send a note with your name and address (snail-mail or e-mail) to Janet Whitener at the San Juan Institute (`janetw@sji.org`).

JOB ANNOUNCEMENTS

The AAS Job Register (`http://www.aas.org/JobRegister/aasjobs.html`) has the most complete and up-to-date listing of astronomy jobs. Here are a selected few jobs I gleaned from the list that may be of interest to Kuiper belt scientists. For brevity, I have omitted the job descriptions, but you can follow the links given below, or from the *Distant EKOs* job page at `http://www.boulder.swri.edu/ekonews/jobs.html`.

. . . . . .

Junior Scientific Researcher

Institute for Astronomy, Hawaii, USA
`http://www.aas.org/JobRegister/no10599.html`

. . . . . .

Postdoctoral Research Associate

Goddard Space Flight Center (Maryland) and NOAO (Tucson), USA
`http://www.aas.org/JobRegister/no10602.html`

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 is deleted from the mailing list. All address changes, submissions, and other correspondence should be sent to:

`ekonews@boulder.swri.edu`