

*Issue No. 7*

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*DISTANT EKOs*   
*The Kuiper Belt Electronic Newsletter*  
*Edited by: Joel Wm. Parker*

[ekonews@boulder.swri.edu](mailto:ekonews@boulder.swri.edu)

[www.boulder.swri.edu/ekonews](http://www.boulder.swri.edu/ekonews)

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## NEWS & ANNOUNCEMENTS

Ethane ice has been detected on Pluto using the Cooled Infrared Spectrograph/Camera (CISCO) instrument on the Subaru Telescope. The ethane appears to be individual grains but is dissolved in the nitrogen ice. Details at: [http://www.subaru.naoj.org/outreach/press\\_releases/990719/](http://www.subaru.naoj.org/outreach/press_releases/990719/)

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With this issue, *Distant EKO*s celebrates its first birthday with 289 subscribers in at least 23 countries. Thanks to all the readers and contributors for your support and feedback to make this a valuable communication tool for Kuiper Belt research.

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There were 17 new EKO discoveries announced since the previous issue of the *Distant EKO*s Newsletter:

1999 DH8, 1999 HG12, 1999 HH12, 1999 HJ12, 1998 SN165, 1999 GS46, 1999 JH132, 1999 JJ132, 1999 JK132, 1999 KR16, 1999 KS16, 1999 KT16, 1999 KK17, 1999 KL17, 1999 OA4, 1999 OY3, 1999 OZ3,

It is possible that 1999 KS16 is a rediscovery of the “lost” object 1995 GA7 (see M.P.E.C. 1999-O36).

Also, a new Centaur was discovered: 1999 OX3

Current number of EKOs: 191 (and Pluto & Charon)

Current number of Centaurs: 15

## **Evidence for Early Stellar Encounters in the Orbital Distribution of Edgeworth-Kuiper Belt Objects**

**Shigeru Ida<sup>1,2</sup>, John Larwood<sup>1,3</sup>, and Andreas Burkert<sup>1</sup>**

<sup>1</sup> Max-Planck-Institut für Astronomie, Königstuhl 17, D-69117 Heidelberg, Germany

<sup>2</sup> Dept. of Earth and Planetary Science, Tokyo Institute of Technology, Tokyo 152-8551, Japan

<sup>3</sup> Astronomy Unit, Queen Mary & Westfield College, London E1 4NS, United Kingdom

We show that early stellar encounters can explain the high eccentricities and inclinations observed in the outer part ( $> 42\text{AU}$ ) of the Edgeworth-Kuiper Belt (EKB). We consider the proto-sun as a member of a stellar aggregation that undergoes dissolution on a timescale  $\sim 10^8$  yrs, such that the solar nebula experiences a flyby encounter at pericenter distance ( $q$ ) on the order of  $100\text{AU}$ . Using numerical simulations we show that a stellar encounter pumps the velocity dispersion in the young solar nebula in the outer parts. In the case of a nearly parabolic encounter with a solar-mass companion the velocity dispersion at  $a \gtrsim 0.25q$  is pumped up to such an extent that collisions between planetesimals would be expected to become highly disruptive, halting further growth of planetesimals. This has the consequence that planet formation is forestalled in that region. We also find that a stellar encounter with pericenter distance  $q \sim 100\text{--}200\text{AU}$  could have pumped up the velocity dispersion of EKB objects outside  $42\text{AU}$  to the observed magnitude while preserving that inside Neptune's 3:2 mean-motion resonance (located at  $39.5\text{AU}$ ). This allows for the efficient capture of objects by the resonance during a phase of orbital migration by proto-Neptune, which we also test with simulations. We point out that such a stellar encounter generally affects the dynamical and material structure of a protoplanetary disk and the planetesimal distribution can remain imprinted with this signature over much of the main sequence lifetime of the star. In particular, our results support the notion that an analogous process has operated in some recently observed extrasolar dust disks.

**To appear in: The Astrophysical Journal**

*For preprints, contact* `ida@geo.titech.ac.jp`

*or on the web at* <http://www.geo.titech.ac.jp/nakazawalab/ida/AJ.html>

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## **Emissivity and the Fate of Pluto's Atmosphere**

**J.A. Stansberry<sup>1</sup> and R.V. Yelle<sup>2</sup>**

<sup>1</sup> Steward Observatory, University of Arizona, Tucson 85721

<sup>2</sup> Physics and Astronomy, Northern Arizona University, Flagstaff 86011

We present a simplified model for seasonal changes in Pluto's surface-atmosphere system. The model demonstrates the potential importance of the solid-state phase transition between  $\alpha\text{-N}_2$  and  $\beta\text{-N}_2$ , and the accompanying change in emissivity, for predicting the seasonal bulk of Pluto's (and Triton's) atmosphere. Specifically, the model shows that under simplified but not unreasonable assumptions Pluto may have nearly the same atmospheric pressure at aphelion as it does now, near

perihelion. The emissivity change which accompanies the  $\alpha - \beta$  phase change should be included in the next generation of Pluto and Triton seasonal models for the purposes of understanding the evolution of their atmospheres over seasonal and climatic time-scales.

**To appear in: Icarus**

*For preprints, contact* `stansber@as.arizona.edu`

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## Near-infrared Spectra of Icy Outer Solar System Surfaces: Remote Determination of H<sub>2</sub>O Ice Temperatures

W.M. Grundy<sup>1</sup>, M.W. Buie<sup>1</sup>, J.A. Stansberry<sup>2</sup>, J.R. Spencer<sup>1</sup>, and B. Schmitt<sup>3</sup>

<sup>1</sup> Lowell Observatory, 1400 W. Mars Hill Rd., Flagstaff AZ 86001

<sup>2</sup> Steward Observatory, University of Arizona, 933 N. Cherry Ave., Tucson AZ 85721

<sup>3</sup> Laboratoire de Planetologie de Grenoble, Batiment D de Physique, B.P. 53, 38041 Grenoble Cedex 9, France

We present new 1.20 to 2.35  $\mu\text{m}$  spectra of satellites of Jupiter, Saturn, and Uranus, and the rings of Saturn, obtained in 1995 and 1998 at Lowell Observatory. For most of the target objects, our data provide considerable improvement in spectral resolution and signal-to-noise over previously published data. Absorption bands with shapes characteristic of low-temperature, hexagonal crystalline H<sub>2</sub>O ice dominate the spectra of most of our targets in this wavelength range. We make use of newly published temperature-dependent wavelengths and relative strengths of H<sub>2</sub>O absorption bands to infer ice temperatures from our spectra. These ice temperatures are distinct from temperatures determined from thermal emission measurements or simulations of radiative balances. Unlike those methods, which average over all terrains including ice-free regions, our temperature-sensing method is only sensitive to the ice component. Our method offers a new constraint which, combined with other observations, can lead to better understanding of thermal properties and textures of remote, icy surfaces. Ice temperatures are generally lower than thermal emission brightness temperatures, indicative of the effects of thermal inertia and segregation between ice and warmer, darker materials. We also present the results of experiments to investigate possible changes of water ice temperature over time, including observations of Titania at two epochs, and of Ganymede and saturnian ring particles following emergence from the eclipse shadows of their primary planets. Finally, we discuss limitations of our temperature measurement method which can result from the presence of H<sub>2</sub>O in phases other than hexagonal ice-I<sub>h</sub>, such as amorphous ice, hydrated mineral phases, or radiation-damaged crystalline ice. Our spectra of Europa and Enceladus exhibit peculiar spectral features which may result from effects such as these.

**To appear in: Icarus**

*For preprints, contact* `grundy@lowell.edu`

*or on the web at* `www.lowell.edu/users/grundy/public/iceT.html`

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# Forming the Dusty Ring in HR 4796A

Scott J. Kenyon<sup>1</sup>, Kenneth Wood<sup>1</sup>, Barbara A. Whitney<sup>2</sup>, and Michael J. Wolff<sup>2</sup>

<sup>1</sup> Harvard-Smithsonian Center for Astrophysics, 60 Garden St, Cambridge, MA 02138 USA

<sup>2</sup> Space Science Institute, Suite 23, 1540 30th Street, Boulder, CO 80303-1012 USA

We describe planetesimal accretion calculations for the dusty ring observed in the nearby A0 star HR 4796A. Models with initial masses of 10–20 times the minimum mass solar nebula produce a ring of width 7–15 AU and height 0.3–0.6 AU at 70 AU in  $\sim 10$  Myr. The ring has a radial optical depth  $\sim 1$ . These results agree with limits derived from infrared images and from the excess infrared luminosity.

**To appear in: The Astrophysical Journal**

*For preprints, contact* `skenyon@cfa.harvard.edu`

*or on the web at* <http://xxx.lanl.gov/abs/astro-ph/9908125>

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## PAPERS RECENTLY SUBMITTED TO JOURNALS

### Triton's Surface Age and Impactor Flux Revisited

S.A. Stern<sup>1</sup>, & W.B. McKinnon<sup>2</sup>

<sup>1</sup> Department of Space Studies, Southwest Research Institute, #426, 1050 Walnut Street, Boulder, CO 80302, USA

<sup>2</sup> Department of Earth and Planetary Sciences and McDonnell Center for the Space Sciences, Washington University, St. Louis, Missouri, USA

Submitted to: The Astronomical Journal

*For preprints, contact* `alan@boulder.swri.edu`

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### Collision Rates in the Present-day Kuiper Belt and Centaur Regions: Applications to Surface Activation and Modification on Comets, Kuiper Belt Objects, Centaurs, and Pluto-Charon

D. D. Durda<sup>1</sup> & S. A. Stern<sup>1</sup>

<sup>1</sup> Department of Space Studies, Southwest Research Institute, #426, 1050 Walnut Street, Boulder, CO 80302, USA

Submitted to: Icarus

*For preprints, contact* `durda@boulder.swri.edu`

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# CONFERENCE CONTRIBUTIONS

The American Astronomical Society's 31st Annual Meeting of the Division of Planetary Science (DPS) meeting will be held October 10–15 in Padova, Italy. The full list of sessions can be found at:

<http://www.aas.org/publications/baas/v31n4/dps99/SL.htm>

Below I list some Kuiper Belt-related papers to be presented at the meeting:

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**Modeling Resonant Structure in the Kuiper Belt**

**E. K. Holmes, S. F. Dermott, K. Grogan**

<http://www.aas.org/publications/baas/v31n4/dps99/363.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 6.03

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**Close Approaches of the trans-Neptunian Objects to Pluto Left Observable Signatures on Their Orbital Distribution**

**F. Roig, D. Nesvorny, S. Ferraz-Mello**

<http://www.aas.org/publications/baas/v31n4/dps99/378.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 15.01

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**The Physical Nature of Centaur Asteroids; Rotation and Colors**

**N. Peixinho, J.L. Ortiz, P.J. Gutierrez), A. Doressoundiram, M. Roos-Serote**

<http://www.aas.org/publications/baas/v31n4/dps99/536.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 15.02

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**1-2.5 Micron Spectra of Centaurs and Trans-Neptunian Objects**

**S. Kern, D. McCarthy, H. Campins, R.H. Brown, M. Rieke, S. Stolovy**

<http://www.aas.org/publications/baas/v31n4/dps99/437.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 15.03

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**Detection of the Kuiper Belt by Stellar Occultation: II**

**M. Moncuquet, F. Roques**

<http://www.aas.org/publications/baas/v31n4/dps99/308.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 15.04

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**Evidence for Early Stellar Encounters in the Orbital Distribution of Edgeworth-Kuiper Belt Objects**

**S. Ida, J.D. Larwood, A. Burkert**

<http://www.aas.org/publications/baas/v31n4/dps99/95.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 15.05

## **Pluto's Family: Might Some Plutinos Be Debris from the Pluto-Charon Binary Formation Event?**

**S.A. Stern, R.M. Canup, E. Asphaug, D.D. Durda**

<http://www.aas.org/publications/baas/v31n4/dps99/62.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 22.01

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## **Cratering Rates in the Outer Solar System**

**K. Zahnle, H. Levison, L. Dones, P. Schenk**

<http://www.aas.org/publications/baas/v31n4/dps99/541.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 22.02

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## **Separate Spectra of Charon and Pluto from HST/NICMOS**

**M.W. Buie, W.M. Grundy, S.D. Kern**

<http://www.aas.org/publications/baas/v31n4/dps99/515.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 22.03

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## **Near-infrared spectral observations of Pluto and Charon**

**W.M. Grundy, M.W. Buie, S.D. Kern**

<http://www.aas.org/publications/baas/v31n4/dps99/526.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 22.04

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## **Kuiper Belt Objects**

**S.C. Tegler, W. Romanishin**

<http://www.aas.org/publications/baas/v31n4/dps99/244.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 23.01

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## **Stability of Volatiles in the Kuiper Belt and in Extra-Solar Dust Disks**

**J. Stansberry, R.H. Brown, J. Lunine, D. Trilling, W. Grundy**

<http://www.aas.org/publications/baas/v31n4/dps99/259.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 23.02

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## **Observations of EKO's and Centaurs: Recoveries, Lightcurves, and Visible-IR Colors**

**J. Wm. Parker, W. D. Vacca**

<http://www.aas.org/publications/baas/v31n4/dps99/248.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 23.03

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## **Broad Band Optical Colors of Trans-Neptunian Objects**

**M.A. Barucci, J. Romon, A. Le Bras, M. Fulchignoni, D. Tholen**

<http://www.aas.org/publications/baas/v31n4/dps99/162.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 23.04

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**A Deep Ecliptic Survey with MOSAIC at Kitt Peak National Observatory**

R. L. Millis, M. W. Buie, L. H. Wasserman, J. L. Elliot, R. M. Wagner

<http://www.aas.org/publications/baas/v31n4/dps99/260.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 26.01

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**The Scattered Kuiper Belt Objects**

C. A. Trujillo, D. C. Jewitt, J. X. Luu

<http://www.aas.org/publications/baas/v31n4/dps99/540.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 26.02

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**Distant TNOs: first results of the ESO survey**

A.C. Delsanti, O.R. Hainaut, H. Boehnhardt, C.E. Delahodde, T. Sekiguchi, R.M. West

<http://www.aas.org/publications/baas/v31n4/dps99/452.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 26.03

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**Pioneer 10 Encounter with a Trans-Neptunian Object at 56 AU?**

G. Giampieri, J.D. Anderson, E.K. Lau

<http://www.aas.org/publications/baas/v31n4/dps99/329.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 26.04

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**Detection of the Kuiper Belt by Stellar Occultation: I**

F. Roques, M. Moncuquet

<http://www.aas.org/publications/baas/v31n4/dps99/309.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 26.05

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**Cometary Activity in TNOs: A Status Report**

O.R. Hainaut, C.E. Delahodde, H. Boehnhardt, E. Dotto, M.A. Barucci, K.J. Meech, J. Bauer, R.M. West, A. Doressoundiram, G.P. Tozzi

<http://www.aas.org/publications/baas/v31n4/dps99/457.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 27.01

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**Exploration at the Edge of the Solar System: The Pluto-Kuiper Express Mission**

R. J. Terrile

<http://www.aas.org/publications/baas/v31n4/dps99/417.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 29.02

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**Pluto, The Edgeworth-Kuiper Belt, and the Pluto-Kuiper Express Flyby Mission**

S.A. Stern

<http://www.aas.org/publications/baas/v31n4/dps99/54.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 29.03



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**Uranus and Neptune: Refugees from the Jupiter-Saturn zone?**

**E. W. Thommes, M. J. Duncan, H. F. Levison**

<http://www.aas.org/publications/baas/v31n4/dps99/124.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 33.09

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**The Effects of Gap Formation and Orbital Migration on Planetary Systems**

**G. Bryden, D. N. C. Lin**

<http://www.aas.org/publications/baas/v31n4/dps99/579.htm>

To appear in: BAAS: AAS/DPS meeting #31, paper 36.06

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**CONFERENCE INFORMATION**

**Pluto and Triton: Comparison and Evolution Over Time**

**23–25 September 1999**

**Lowell Observatory, Flagstaff, Arizona, USA**

<http://www.lowell.edu/workshop>

A decade after the Voyager flyby of Triton and the end of the Pluto/Charon mutual event season, this meeting will provide an opportunity to synthesize recent investigations of this fascinating class of worlds and to explore and compare processes affecting them over time scales ranging from diurnal to cosmological. Themes to be addressed include recent data, interpretations, and models, as well as consideration of what are the most pressing unanswered questions and how they can be resolved through future work.

For more information, visit: <http://www.lowell.edu/workshop>

There will not be a proceedings volume published from this conference (although abstracts will be available at the website). However, there will be a special Pluto/Triton issue of *Icarus*. Papers can be submitted by any authors, regardless of whether they attended this workshop or not. Submission deadline is November 15, 1999.

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# The New Era of Wide-Field Astronomy

2000 August 21–24

Centre for Astrophysics, University Of Central Lancashire, Preston, UK

[http://www.uclan.ac.uk/new\\_era](http://www.uclan.ac.uk/new_era)

The conference is prompted by the success of the UK Joint Infrastructure Fund bid for VISTA — the Visible and Infrared Survey Telescope for Astronomy — a 4-m survey telescope to be constructed in Chile by late 2003.

We are at the beginning of a new era in wide-field astronomy, with major new surveys now in production, and with new telescopes and instruments, both ground- and space-based, scheduled to be in production in the next few years. This conference aims to review the present and future of this exciting new era of wide-field astronomy, and to discuss the optimum exploitation of the remarkable range of new facilities.

The conference will cover all aspects of the new era — cosmology and both extragalactic and galactic astronomy, from X-ray to radio. Themes include the following:

- The new generation of telescopes and instruments (for example, VISTA, VST, XMM, Chandra, SALT, MegaPrime, OmegaCAM, UKIRT WF, 6dF).
- Astronomy and cosmology being done now (AAT 2dF, INT-WFC, SDSS, ELAIS, EIS).
- Astronomy and cosmology that will be possible in future (VISTA/Gemini, XMM, Chandra, MAP, Planck).
- Data access and analysis.

For more information and preliminary registration visit the conference web site at [http://www.uclan.ac.uk/new\\_era](http://www.uclan.ac.uk/new_era)

## CONTACT:

Centre for Astrophysics  
Attn: Dr R.G. Clowes  
University of Central Lancashire  
Preston  
PR1 2HE  
United Kingdom

Phone: +44 (0) 1772 893540

Fax: +44 (0) 1772 892996

E-mail: [r.g.clowes@uclan.ac.uk](mailto:r.g.clowes@uclan.ac.uk)

# **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>.

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## **Lowell Postdoctoral Fellowship**

**Lowell Observatory, Flagstaff, Arizona, USA**

[http://www.lowell.edu/misc/post\\_doc.html](http://www.lowell.edu/misc/post_doc.html)

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## **Planetary Science Faculty Position**

**Massachusetts Institute of Technology, Cambridge, Massachusetts, USA**

<http://www.aas.org/JobRegister/no10696.html>

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The *Distant EKO*s 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 L<sup>A</sup>T<sub>E</sub>X 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 EKO*s 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 EKO*s 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 EKO*s 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`