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Date: Fri, 21 Jan 2005 13:33:51 -0500
To: Lindley Johnson <Lindley.Johnson-1@nasa.gov>
From: James Elliot <jle@MIT.EDU>
Subject: Progress Report for NNG04GF25G (through 2005-01-31)
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"Magoveny, Cheryl" <magoveny@mit.edu>, "Person, Michael" <mjperson@mit.edu>
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Lindley:

Below is my annual progress report (through 2005-01-31) on NASA Grant NNG04GF25G. As you suggested to Allison Cocuzzo, it is organized according to (i) accomplishments in the last year against the objectives laid out in the original proposal, (ii) the current status of the research, (iii) the work to go in the next year, and (iv) publications. Since this program is a continuation of the occultation work supported in a predecessor grant, the "ACCOMPLISHMENTS" section lists all the tasks that we wrote into the proposal (in June 2003) through the end of the first year of the new grant. Let me know if you need any more information.

Jim

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ACCOMPLISHMENTS (proposed tasks preceded by "*")
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* Complete analysis of Tr231 data and prepare for publication (G, PI)

The data obtained from the Tr231 occultation had been partially reduced and initial results confirming persistence of the general thermal structure of Triton's atmosphere were presented at the 2001 meeting of the DPS (Person, M. J., Elliot, J. L., Pate, J., Glass, I., Stone, R. C., Morzinski, K. M., & Dunham, E. W. 2001, BAAS, 33, 1130). Those results did not specifically support or refute the previously observed warming trend in Triton's lower atmosphere because the closest approach distance of the occultation could not be determined from the lone chord obtained.

Currently, astrometry data obtained at the time of the event are being analyzed to constrain the closest approach distance of the event and thus eliminate the major variable in modeling. Once complete, this will allow inversion of the light curve, resulting in specific temperature and pressure profiles that can be compared to the previously observed events.

The astrometry work is currently in progress, as part of Michael Person's PhD thesis preparation, and the results of the astrometry and subsequent atmospheric analyses will be submitted for publication contemporaneously with inclusion in this thesis.

* Complete and publish analysis of Pluto's atmospheric shape from the P131.1 data (G, PI)
This work is complete, and a paper will be submitted to Icarus within the next two weeks (following coauthor review).

* Complete and publish analysis of P131.1 SpeX data (PI, TS)
This project was put on hold, in favor of working with our Williams colleagues on further analysis of the UH 2.2m light curve for P131.1. The results of this work are now in press (Pasachoff, et al. 2005 -- see below).

* Predict and observe the Tr266 occultation (PI, TS)
This event was attempted at the IRTF (in collaboration with Leslie Young), but the conditions proved too poor to get good results, unfortunately.

* Complete analysis and publish the Magellan resolved photometry for Pluto-Charon (TS, PI, G)
This has been completed (Clancy et al. 2005 -- see below).

* Refine astrometric predictions to high accuracy for 2004 events in Table 1 (PD, TS)
We examined these events further, but none proved sufficiently good to warrant an observational effort.

* Begin candidate search program with USNO-B for KBOs (PD)
The software for this has been completed, and candidate lists have been generated. Before viable candidates can be identified, however, we need to improve the KBO orbits (see below).

* Magellan guide camera software upgrades to enable occultation observations (PD)
We are discussing this upgrade with other Magellan users in order to share the software effort (to reduce its cost).

* Photometric observations of promising candidate stars not in UCAC2 (TS)
Observing plans are in progress.

• Compile and publish initial list of KBO occultation candidates, 2004-2010 (PD, TS, PI)
Although we have candidate lists (see above), most of these will not be observable from Earth because the KBO orbit errors are too large. We have begun to make the necessary orbit improvements with an observational program at Lowell Observatory (see next item).

* KBO orbit refinement and occultation observations (PI, PD, TS)
Observations for this are underway on a bi-monthly basis at Lowell Observatory, and we have discussed with Brian Marsden about beta testing the proposed new MPC format to flag the high-quality KBO astrometry (needed from the entire community to generate more accurate orbits).

* Possibly observe P257 in Western US and P228.1 in Australia (PI, G)
These events are not as favorable as the C313.2 Charon occultation that should be visible from South America on 2005 July 11 (UT). We are in close contact with our Williams College colleagues about a major observational effort on this. We are also coordinating with Leslie Young at SWRI.

* Initial analysis of successful events prepared for publication (PI, PD, G, TS)
A first look analysis of the 2003 November Titan occultation (a data set obtained by A. Fitzsimmons and his colleagues) has been completed by graduate student Angela Zalucha.

* Refine astrometric predictions to high accuracy for 2005 events in Table 1 (TS, G)
A major effort is underway to refine the prediction for this summer's Charon occultation (C313.2 event).

CURRENT STATUS AND PLANS FOR NEXT YEAR

C. Second Year (2005-02-01->2006-01-31)
* Complete analysis of successful 2006 events Charon (PD, PI), Pluto (PI, PD), Triton (PI, G)
We are anticipating a good data set for the Charon occultation this summer (if the weather cooperates).

* KBO orbit refinement and occultation observations (PI, PD, TS)
This work is underway and will continue.

* Possibly observe P289 in Hawaii (PI, TS, G)
This looks like a miss.

* Possibly observe P/C292 or Tr284 in Australia (PI, PD)
We have decided that the prospects for the C313.2 event are much better, so we are planning to observe it instead.

* Refine astrometric predictions to high accuracy for 2006 events in Table 1 (TS, G)
This will go forward, with an emphasis on the C313.2 event.

* Initial analysis of successful events prepared for publication (PI, PD, G)
We expect to prepare a paper on the 2003 November Titan occultation, that is currently being analyzed by graduate student A. Zalucha (under supervision of the PI).

PUBLICATIONS (2003-2005)

Clancy, K. B., J. L. Elliot, and M. J. Person 2005. Charon/Pluto Light Ratio. In Highlights of Astronomy Ed.), pp. (in press).

Person, M. J., J. L. Elliot, K. A. Emanuel, J. M. Pasachoff, B. A. Babcock, S. P. Souza, M. W. Buie, E. W. Dunham, B. W. Taylor, A. S. Bosh, L. C. Roberts Jr., D. T. Hall, D. J. Tholen, S. S. Eikenberry, and S. E. Levine 2005. Pluto's lumpy atmosphere. Icarus (to be submitted).

Elliot, J. L., A. Ates, B. A. Babcock, A. S. Bosh, M. W. Buie, K. B. Clancy, E. W. Dunham, S. S. Eikenberry, D. T. Hall, S. D. Kern, S. K. Leggett, S. E. Levine, D.-S. Moon, C. B. Olkin, D. J. Osip, J. M. Pasachoff, B. E. Penprase, M. J. Person, S. Qu, J. T. Rayner, L. C. Roberts Jr., C. V. Salyk, S. P. Souza, R. C. Stone, B. W. Taylor, D. J. Tholen, J. E. Thomas-Osip, D. R. Ticehurst, and L. H. Wasserman 2003. The recent expansion of Pluto's atmosphere. Nature 424, 165-168.

Elliot, J. L., and S. D. Kern 2003. Pluto's atmosphere and a targeted-occultation search for other bound KBO atmospheres. Earth, Moon, and Planets 92, 375-393.

Elliot, J. L., S. D. Kern, K. B. Clancy, A. A. S. Gulbis, R. L. Millis, M. W. Buie, L. H. Wasserman, E. I. Chiang, A. B. Jordan, D. E. Trilling, and K. J. Meech 2005. The Deep Ecliptic Survey: A search for Kuiper belt objects and Centaurs. II. Dynamical classification, the Kuiper belt plane, and the core population. Astron. J. 129, (in press).

Elliot, J. L., M. J. Person, and S. Qu 2003. Analysis of stellar occultation data. II. Inversion, with application to Pluto and Triton. Astron. J. 126, 1041-1079.

Pasachoff, J. M., S. P. Souza, B. A. Babcock, D. R. Ticehurst, J. L. Elliot, M. J. Person, K. B. clancy, L. C. Roberts Jr., D. T. Hall, and D. J. Tholen 2005. The structure of Pluto's atmosphere form the 2002 August 21 stellar occultation. Astron. J. 129, (in press).

Person, M. J., J. L. Elliot, K. A. Emanuel, J. M. Pasachoff, B. A. Babcock, S. P. Souza, M. W. Buie, E. W. Dunham, B. W. Taylor, A. S. Bosh, L. C. Roberts Jr., D. T. Hall, D. J. Tholen, S. S. Eikenberry, and S. E. Levine 2005. Pluto's lumpy atmosphere. Icarus (to be submitted).