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Limits on Pluto's Ring System from the June 12 2006 Stellar Occultation

H. B. Throop (1,4), R. G. French (2), K. Shoemaker (3), C. R. Ruhland (4,5), L. A. Young (4), C. B. Olkin (4).
(1) Planetary Science Institute, Tucson, AZ, (2) Wellesley College, Wellesley, MA, (3) Shoemaker Labs, Lafayette, CO, (4) Southwest Research Institute, Boulder, CO, (5) Colorado Supreme Court, Denver, CO (throop@psi.edu)

Abstract

We present new detection limits on Pluto's ring system from the stellar occultation of P384.2 by Pluto, as observed from the Anglo-American Telescope. Our analysis to date has not found any evidence for a ring system or other unknown detectable material within the bounds of Hydra's orbit.

1. Introduction

Pluto's occultation of the R=14.8 magnitude star P384.2 on 2006 Jun 12 was visible from the southern hemisphere. Results from the occultation of Pluto in our dataset have been published elsewhere [4]. In this work, we took advantage of the 2.5 hour length of our dataset to search it for additional occultations of P384.2 caused by material in the Pluto system, such as rings or additional satellites. Dusty rings at Pluto might naturally exist at the orbits of the satellites, which would provide a source of material as ejecta from micrometeoroid impacts is placed into the local environment.

2. Observations

We (RF and KS) observed P384.2 using the 3.9 meter Anglo-Australian Telescope at Sliding Springs, Australia. Images were taken for using a Roper Instruments CCD at 10 Hz (3.5 km/sample), binned on-chip to 64x64 pixels [5]. Observations started roughly two hours before the occultation and ended 30 minutes afterwards, yielding approximately 86,000 individual frames spanning 2.5 hours. Data were taken continually, with short gaps every 20 minutes. The time for the orbits of Charon, Nix, and Hydra to all pass directly over P384.2 on both ingress and egress is approximately one hour, and our dataset spans this period completely.

3. Data analysis

We used aperture photometry to measure the brightness of Pluto, P384.2, and four field stars on every frame. Photometry apertures were typically 6.5 pixels in diameter, increasing somewhat when Pluto and P3484.2 approached each other in the field. After processing, the P384.2 light curve is extremely stable, with SNR ~ 100. Using SPICE, we determined the times at which the projected orbits of Charon, Nix, Hydra, and the Pluto barycenter would cross the line-of-sight to P384.2.

We searched the data set for any signals arising from additional occultations. We searched in particular for events which correlated with orbital crossing times, with the expectation that meteoroid impacts into the satellites could be the source of ring material, as they are in the dusty rings of the giant planets. We found no such detectable features at the several-percent level.

4. Conclusions

We have found no evidence for previously unknown material in the Pluto system, either correlated with known satellite locations or elsewhere. We will present our formal upper limits for material in this region, and compare it to limits from occultations [1, 2] and direct imaging [3].

Acknowledgements

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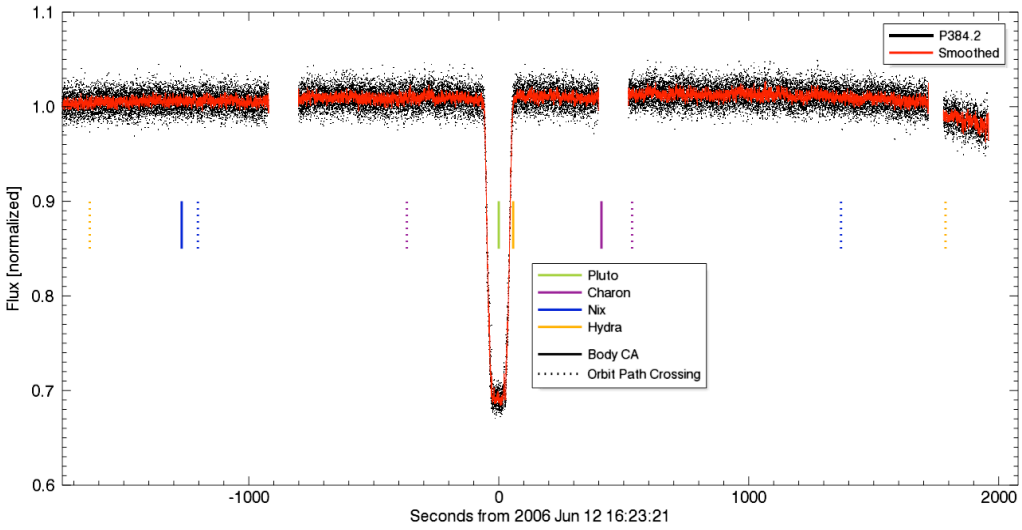

Figure 1: Light curve from the 3.9-meter AAT observations of Pluto's occultation of P384.2. Shown here is the central hour of our 2.5-hour data set; this plot spans the ingress and egress of the orbits of Charon, Nix, and Hydra across P384.2 (dashed colored lines). The two-minute gaps are for data readout and timer synchronization. We find no obvious signature of rings at these orbit crossings or elsewhere in the dataset.