

## Search for serendipitous Oort Cloud Object occultation in X-rays

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### Abstract

The existence of Oort cloud objects remains a hypothesis since proposed more than half a century ago. Here we report the results of search for serendipitous occultation events caused by Oort Cloud Objects (OCOs) using Rossi X-ray Timing Explorer/Proportional Counter Array (RXTE/PCA) data of Sco X-1 taken from 1996 February to 2012 January. We also investigate the dependence of detection efficiency on OCO size to better define the sensible size range of our approach.

### 1. Introduction

Serendipitous occultation search is an indirect way used to study small outer Solar system objects (e.g., Kuiper Belt Objects (KBOs) and OCOs) by extracting and analyzing diffraction patterns in the occultation light curves. From the literature, there are already several possible detections or upper-limits reported in both optical and X-ray bands by using this method for the search of small KBOs.

Besides KBOs, this method also has the potential to extend the search to a distance as far away as the Oort cloud region (beyond a few thousands AU). As the distance is larger, a point source may not be a good approximation of the background source since the projected emitting area could be comparable or larger than a Fresnel scale. The X-ray emitting region in Sco X-1, based on different models, varies from about 50 km to 50,000 km, the latter of which translates to about 1 Fresnel scale at 4000 AU for X-rays at 4 keV, and about 3 Fresnel scales at 36000 AU. We consider all these factors in the investigation of detection efficiencies of our approach. Figure 1 shows some computed diffraction patterns.

We are analyzing Sco X-1 data taken by RXTE/PCA from 1996 February to 2011 October, in total about 1 Msec, to find dip events at time scales of a few tens milliseconds. We expect to report in the meeting our findings.

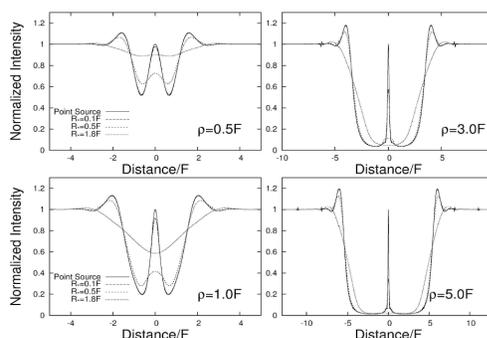


Figure 1: Diffraction intensity profiles for different occulting object and background source sizes with a given background source emission spectrum. Different panels are for different occulting object sizes. Each curve in a panel is for different background source sizes. “F” stands for the Fresnel scale.

### References

- [1] Hsiang-Kuang Chang; Chih-Yuan Liu; Kuan-Ting Chen: Search for serendipitous trans-Neptunian object occultation in X-rays, 2013, MNRAS 429, 1626–1632
- [2] Roques, F.; Moncuquet, M.; Sicardy, B.: Stellar occultations by small bodies - Diffraction effects, 1987, AJ, 93, 1549