The Chandra Delta Ori Large Project: Occultation Measurements Of The Shocked Gas In The Nearest Eclipsing O-Star Binary

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Introduction

Delta Ori is the nearest massive, single-lined eclipsing binary (O9.5 II + B0.5III). As such it serves as a fundamental calibrator of the mass-radius-luminosity relation in the upper HR diagram. It is also the only eclipsing O-type binary system which is bright enough to be observable with the CHANDRA gratings in a reasonable exposure. Studies of resolved X-ray line complexes provide tracers of wind mass loss rate and clumpiness; occultation by the X-ray dark companion of the line emitting region can provide direct spatial information on the location of the X-ray emitting gas produced by shocks embedded in the wind of the primary star. We obtained phase-resolved spectra with Chandra in order to determine the level of phase-dependent vs. secular variability in the shocked wind. Along with the Chandra observations we obtained simultaneous photometry from space with the Canadian MOST satellite to help understand the relation between X-ray and photospheric variability.

The Delta Ori HETGS spectrum:

X-ray and Optical Variability

• Unusually large variations in the X-ray lightcurve.
• Significant non-phase-locked photometric variations: pulsations?

He-like Lines: Mg XI and Si XIII

Summary

In December 2012 Delta Ori was observed by Chandra using the HETGS for a total of 478 ksec spanning an entire orbital cycle. Simultaneous photometric data with MOST was obtained. These observations show changes in the optical and X-ray photometry and X-ray emission line spectrum which are not strictly phase-locked, along with phase-locked variability.

See Poster by Nichols et al. for a summary of the variability analysis.