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SYMPOSIUM ON TECHNOLOGICAL REQUIREMENTS FOR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS (A7)
Scientific Motivation and Requirements for Future Space Astronomy and Solar System Science Missions (2)

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A SURVEY OF ECLIPSING BINARIES WITH THE ULTRAVIOLET TRANSIENT ASTRONOMY SATELLITE (ULTRASAT)

Abstract

Eclipsing Binaries (EBs) are systems of two stars orbiting around their common center of mass, with an orbit oriented along our line of sight, in a way that the stars successively eclipse and transit each other.

ULTRASAT (the Ultraviolet Transient Astronomy Satellite[1]) is a proposed mission by an Israeli-US collaboration including the Weizmann Institute of Science, Caltech and JPL. It will revolutionize our understanding of the transient ultraviolet (UV) universe by undertaking the first wide-field, UV time-domain survey of the sky. ULTRASAT will explore the rich UV transient sky: supernovae, supermassive black holes, tidal disruption events, the counterparts to gravitational-wave sources, cosmic relativistic explosions, variable stars, and other exciting phenomena.

As the first UV wide-field transient astronomy explorer, ULTRASAT offers a unique opportunity to carry out a survey of EBs in the unexplored UV domain of the electromagnetic spectrum. Although primarily designed to investigate supernovae and supermassive black holes, ULTRASAT is optimally suited for implementing EB observations and can open up the spectral horizons for the study of such systems.

The light curves of EB contain a wealth of information about these systems, such as the stellar radii and shapes, the orbital inclination and eccentricity, and the stellar surface brightness profile. The traditional

[1]http://www.weizmann.ac.il/astrophysics/ultrasat

(visible domain) EB light curve is expected to look very different in the UV. The UV emission from the chromosphere, a hot atmospheric layer lying between the photosphere and the corona, is predicted to leave a distinctive signature into the light curve: two distinctive dips, repeating periodically, taking place when the transiting star crosses the limb of the occulted one. As a result, measurement of the stellar UV light curve would allow to spatially map the chromosphere of distant, unresolved stars and provide useful information that has never been accessed before, about the size and geometry of stellar chromospheres.

In addition to mapping chromospheric emission, the ULTRASAT band can be used very efficiently to probe systems with different temperatures and therefore high contrast between the eclipsing objects. It will provide excellent observational access to two types of attractive targets. On the one hand, binary systems involving young chromospherically active stars with ages of only a few million years will provide a new insights into the formation and early co-evolution of such systems. On the other hand, white dwarfs, with their small radii, will allow detection of even smaller transiting stars or planets, opening opportunities for new discoveries.