SHAPES AND MULTIPLICITIES OF VESTA FAMILY ASTEROIDS: IMPLICATIONS FOR THEIR COLLISIONAL ORIGIN

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A photometric survey of the Vesta family of asteroids was initiated in order to better understand the outcomes of large-scale collisions in the solar system. This family was originally chosen because of its spectrally distinct crustal composition (basaltic) which permits any fragments excavated from it to be easily traceable. Further, the large impact basin on its southern hemisphere is likely to be the source region for the Vesta 'chips', making the Vesta family an ideal subject for the study of large scale cratering impacts. Recently, however, it has been speculated that several collisional events may have contributed to what is currently identified as the Vesta asteroid family, so additional complexities may have to be factored into the evaluation of the collected data.

Since our primary objective is to determine the shape characteristics of the fragments from an impact event, we chose to focus on a small number of targets for which we could obtain detailed photometry during multiple apparitions. Most of the objects observed have displayed the usual doubly periodic lightcurves associated with tri-axial ellipsoids. However, a few have revealed more unusual features. In particular, the lightcurves of 3782 Celle (Ryan et al. 2004a) and 3703 Volkonskaya (Ryan et al. 2004b) are indicative of asynchronous binary systems. In addition, other targets within this survey have revealed unusual lightcurve features that have the appearance of anomalous attenuations, but with periodicities that appear to be synchronous with the primary's rotation.

In the present work, we provide a summary of the latest results of this survey. In particular, we present models of the 3782 Celle and 3703 Volkonskaya binary systems based on anomalous attenuation events observed at differing observing geometries of multiple apparitions, and comment on the implications for understanding satellite formation in subcatastrophic collisions.

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References

Ryan, W. H., Ryan, E. V., Martinez, C. T., 2004a; Planet. Space Sci. 52, 1093-1101.
Ryan, W. H., Ryan, E. V., Martinez, C. T., 2004b; Bul. Amer. Astron. Soc. 36, 1181-1182.