

## HIGH-RESOLUTION RESONANT STRUCTURE OF THE ASTEROID BELT

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**Abstract:** The synthetic orbital frequencies and eccentricities of main belt asteroids computed by Knezevic and Milani[1] and catalogued in the AstDys proper element database show evidence that the structure of the asteroid belt has been determined by a dense web of high-order resonances. By examining the orbital element distribution at high resolution, we show that the eccentricities of asteroids trapped in resonance tend to be higher than those of non-resonant asteroids. By analyzing how the observed increase in mean eccentricity depends on asteroid size, we also show that the effect decreases with increasing size and does not exist for asteroids with absolute magnitude less than 13.5. These observations can be accounted for by orbital evolution due to Yarkovsky forces and we argue that it is possible to use the observed increases in mean eccentricity to place limits on the strengths of those forces. The observations may also provide information on the ages of some families and on the variation of mean asteroid age with diameter.

**References:** [1] Knezevic, Z. and Milani, A. (2000). *Celest. Mech. Dynam. Astron.* Vol. 78, pp. 17-46.

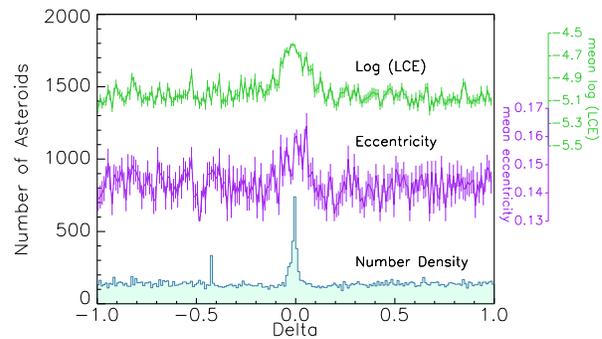


Figure 1.

The resonant structure of the inner asteroid belt ( $2.1 < a < 2.5$  AU) is investigated using a histogram of the delta values of 28,844 asteroids in a bias-free set that is complete and devoid of observational selection effects.

Only 2-body mean motion resonances with Mars of order  $q < 31$  are used in the plot. Delta is a measure of the displacement of each asteroid from the two resonances that bound it from above and below, with  $\delta = 0$  occurring at exact resonance.

The three plots show the variation of mean eccentricity, mean  $\log(LCE)$  and number density with delta and reveal a significant increase of mean eccentricity and mean LCE at  $\delta = 0$ , that is, at exact resonance. These increases occur for all magnitude  $H$  ranges except for that range of  $H < 13.5$  that contains the 2,354 largest asteroids.