**CONSTRAINING THE INTERIORS OF ASTEROIDS THROUGH CLOSE ENCOUNTERS.** J. T. Dinsmore[1] and J. de Wit[2], [1]Massachusetts Institute of Technology Department of Physics, jtdinsmo@mit.edu; [2]Massachusetts Institute of Technology Department of Earth, Atmospheric, and Planetary Sciences.

We develop a new method for extracting asteroid interior density distributions from rotational velocity data gathered during a close encounter. We perform injection-retrieval analysis for a large sample of synthetic close encounters using MCMC and derive the typical performance of such a method. We then apply this framework to Apophis to determine the insights that could be gained regarding its interior and guide the observational set up that would be required to best leverage its 2029 flyby. Finally, we discuss the degeneracy between the density moments and the actual density distribution and propose three models to construct a representative density distribution from fit results.

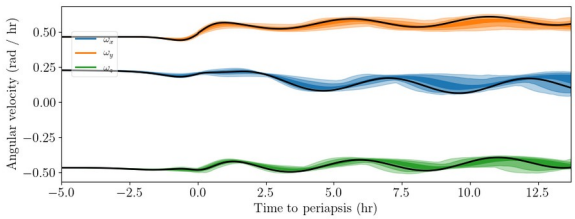


**FIG 1.** Angular velocities of a population of 1000 asteroids evolving over a close encounter. Bands include 68%, (dark) 95%, and 99.7% (light) of the population. Tidal torque causes the angular velocities to spread during perigee.

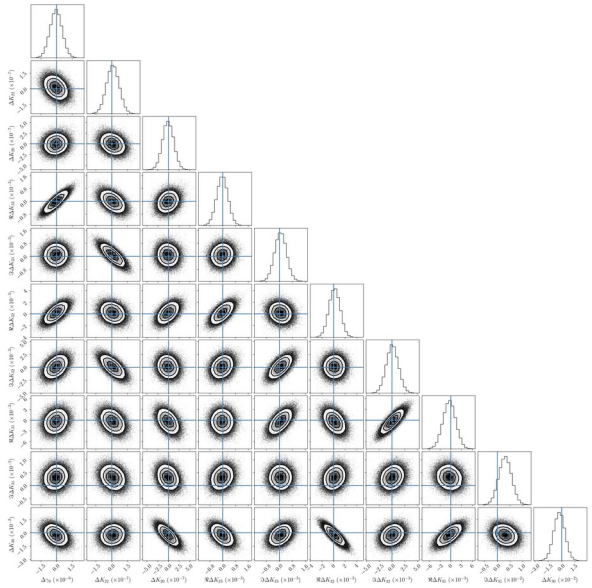

**FIG 2.** Posterior probability distributions for ten density moments of a sample asteroid inferred via MCMC from synthetic data. Flat priors were used.