THE EFFECTS OF ROTATIONAL FISSION ON THE MAIN BELT ASTEROID POPULATION. S. A. Jacobson[1], D. J. Scheeres[2], A. Rossi[3] and F. Marzari[4], [1]Laboratoire Lagrange, Observatoire de la Côte d'Azur, B.P. 4229, 06304 Nice Cedex 4, France (seth.jacobson@oca.eu), [2]University of Colorado, Boulder, CO, USA, [3]IFAC-CNR, 50019 Sesto Fiorentino, Italy, [4]Università di Padova, 35131 Padova, Italy.

Introduction: From the results of a comprehensive asteroid population evolution model, we conclude that the YORP-induced rotational fission hypothesis is consistent with the observed sub-populations of binary asteroids, asteroid pairs and contact binaries. The foundation of this model is the asteroid rotation model of [1] which incorporates both the YORP effect and collisional evolution. This work adds to that model the rotational fission hypothesis in [2] and the binary evolution model of [3,4]. The asteroid population evolution model is highly constrained by these and other previous works, and therefore it has only two significant free parameters: the ratio of low to high mass ratio binaries formed after rotational fission events and the mean strength of the binary YORP (BYORP) effect.

Results: We successfully reproduce the observed small asteroid sub-populations, which orthogonally constrain the two free parameters. We find the outcome of rotational fission most likely produces an initial mass ratio fraction that is four to eight times as likely to produce high mass ratio systems as low mass ratio systems, which is consistent with rotational fission creating binary systems in a flat distribution with respect to mass ratio. An initially counter-intuitive result given the abundance of low mass ratio binary systems compared to high mass ratio binary systems, however the BYORP-tidal equilibrium hypothesis predicts that low mass ratio binaries survive for a significantly longer period of time than high mass ratio systems. We also find that the mean of the log-normal BYORP coefficient distribution $B \approx 10^{-2}$ which is consistent with recent shape modelling estimates by [5].

References: [1] F. Marzari et al., Icarus, 214, 2, 622-631 (2011), [2] S. Jacobson et al., MNRAS, in press, (2014), [3] S. Jacobson & D. J. Scheeres, Icarus, 214, 1, 161-178 (2011), [4] S. Jacobson & D. J. Scheeres, ApJL, 736, 1, L19 (2011), [5] J. McMahon & D. J. Scheeres, AAS, DPS meeting #44, #105.08