Mem. S.A.It. Vol. 87, 200

Memorie della

YORP and collisional shaping of the sub-populations, rotation rate and size-frequency distributions in the main-belt

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Abstract.

In the last several years a comprehensive asteroid-population-evolution model was developed incorporating both the YORP effect and collisional evolution (Rossi et al. 2009), (Marzari et al. 2011), (Jacobson et al. 2014).

From the results of this model we were able to match the observed main belt rotation rate distribution and to give a first plausible explanation of the observed excess of slow rotators, through a random walk-like evolution of the spin, induced by repeated collisions with small projectiles.

Moreover, adding to the model the rotational fission hypothesis (i.e. when the rotation rate exceeds a critical value, erosion and binary formation occur; Scheeres 2007) and binary-asteroid evolution (Jacobson & Scheeres 2011), we first showed that the YORP-induced rotational-fission hypothesis has strong repercussions for the small size end of the main-belt asteroid size-frequency distribution.

We also concluded that this hypothesis is consistent with observed asteroid-population statistics and with the observed sub-populations of binary asteroids, asteroid pairs and contact binaries. An overview of the results obtained, the modelling uncertainties and the ongoing work will be given.

References

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