Long-term effects of close encounters with (3) Juno, (20) Massalia, (31) Euphrosyne, and (111) Ate

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The inaccuracy in the determination of asteroid masses represents the major limitation for the performance of modern ephemerids. We describe and use in this work a dynamical method to determine the masses of four asteroids: (3) Juno, (20) Massalia, (31) Euphrosyne, and (111) Ate, based on the observational study of deflection caused by these asteroids on other smaller ones. A list of the encounters likely to produce mass determination for each one of our sample asteroids are presented in this work. We selected encounters whose separation between the two asteroids was less than 0.01 au, and with an angle (θ_1), which is the scattering angle between the orbits of the target asteroid with and without the studied mass at the moment of close encounter, larger than 0.1 arcsec. After that, the distance between the two positions of the target asteroid were calculated after 30 days of each possible close encounter, with and without the perturbing asteroid. We then checked if the orbital change of the asteroid is observable from Earth. We aim to follow-up each one of the close encounters listed here, using the most appropriate method of observation, in order to determine the mass of our studied objects with good accuracy. This kind of study is all the more interesting since the astrometric space mission Gaia is on the verge of detecting some of the deflections investigated here.

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References: Aljbaae, S., Souchay, J., Carruba, V., 2014, MNRAS, in preparation.