

The Rosetta asteroidal flybys

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On its course to the comet 67P/Churyumov-Gerasimenko, Rosetta will fly past two Main Belt asteroids: 2867 Steins and 21 Lutetia. These two bodies reflect the large diversity in the asteroidal population, with Steins being a small (few km of diameter) E-type asteroid and Lutetia being a very large (diameter ~ 100 km) possibly M-type object. The probe will fly past Steins at about 9 km/s at a distance of about 1700 km, during its first passage in the Main Belt. The Lutetia flyby will take place, during the second passage in the Main Belt, at a distance of about 3000 km, with a speed of 15 km/s. The large mass of 21 Lutetia will slightly deviate the trajectory of the probe causing a visible signal in the Doppler tracking residuals. This deviation should be comparable to the one experienced by NEAR while passing by 253 Mathilde and will allow the determination of the mass of the asteroid. Together with the estimate of the body volume, derived by the camera measurements, an estimate of the average density of the object will be possible. On the other hand Steins is too small to allow a radio science estimate of its mass. In this paper the dynamical environment around 21 Lutetia is described. The amplitude of the orbital stability zone is estimated both in the framework of the restricted three body problem and numerically. This characterizes the zone where, not only possible satellites, but also small debris that could impact the probe could be found. Moreover some estimates on the accuracy of the expected radio science results at Lutetia are given.