Masses of a number of asteroids obtained by the dynamical method

Y. Chernetenko[1], O. Kochetova[1], and V. Kuznetcov[1]

[1]Institute of Applied Astronomy, Russian Academy of Sciences, Saint Petersburg

We calculated masses for 65 asteroids using optical and radar (if available) observations of perturbed asteroids. For a majority of mass values obtained, the errors do not exceed 10^{-12} solar masses. Optical observations were corrected for systematic errors of star catalogues. The contribution of the radar observations to the mass values and to the error estimates of the masses is small. All mass determinations were carried out by improving the orbital parameters of asteroids using the least-squares method. We considered several variants of solutions:
i) determination of mass of one perturbing asteroid using observations of a number of asteroids which were considered as test particles and should have sizes less than the size of the perturbing asteroid (in fact, their number does not exceed 50);
ii) determination of masses of two or three gravitationally interacting asteroids using only their observations;
iii) determination of masses of several gravitationally interacting asteroids using their observations and observations of other asteroids (test particles);
iv) determination of a consistent system of masses for large asteroids.

A comparison of the efficiency of these approaches was carried out. It was found that the last variant is too complicated and less effective than the other considered variants. A comparison of our results with those of other authors, based on optical observations of asteroids as well as on the radar measurements of the time delay of signals was fulfilled. One can conclude that the mass determinations resulting from these two types of observations do not contradict each other. Our calculations show that the accuracy of mass determination for the cases considered by us in 2004–2014 asteroids have improved by a factor of 1.5 to 5. This is a cumulative result of several components.