

SPACE EXPLORATION SYMPOSIUM (A3)
Poster Session (P)

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ESTIMATION OF TOUTATIS MASS BASED UPON THE TRACKING DATA DURING CHANG'E-2
FLY-BY**Abstract**

The mass and density are helpful to the understanding of the composition of an asteroid, and are difficult to determine. Up to now, only a few of asteroids have been studied for the mass, and the accuracy of the determined mass is quite high. As the development of human deep space exploration, the tracking data of the asteroids at the fly-by provide good opportunity to estimate the asteroids' mass. On December 13, 2012, Chang'E-2 flew-by Toutatis at a minimum distance of 2 km, and hundreds of optical images were obtained from the solar monitoring camera. This is the first attempt for China's asteroid exploration, and the basic goal of the extended mission is to get the optical images at a distance as close as possible. In this manuscript, we studied the estimation of the mass of Toutatis. First, we extracted the relative information between CE-2 and Toutatis from the optical images. Then, the perturbation force acting on Chang'E-2 from Toutatis is analyzed. We also performed a numerical simulation for the mass estimation under current tracking condition. Finally, we determined the mass of Toutatis based upon the ground-based tracking data of Chang'E-2 and the historical tracking data of Toutatis.