A Simulation of Mass Determination of Asteroid (469219) 2016 HO3

*Weitong Jin[1], Fei Li[1,2], Jianguo Yan[1], Xuan Yang[1], Mao Ye[1]

1. State Key Laboratory of Information Engineering in Surveying Mapping and Remote Sensing, Wuhan University, China, 2. Chinese Antarctic Center of Surveying and Mapping, Wuhan University, China

An asteroid is an effective indicator of the origin of our primitive solar system and life. The asteroid (469219) 2016 HO3, as the most stable quasi-satellite of Earth for future centuries, is a scientific interesting object due to its special orbit. 2016 HO3 spends about half of the time closer to the Sun than Earth passing ahead of our planet, and about half of the time farther away causing it to fall behind. Its orbit is also tilted a little, causing it to bob up and then down once each year through Earth's orbital plane, resembling a game of leap frog with Earth. This body is one of the potential objects possible to be explored in the first Chinese asteroid mission in 2025. However, the mass of the asteroid, as an important parameter to estimate the bulk density for clues to its internal structure, has not been determined with a high precision so far. In this paper, several simulation cases of radio tracking mode were performed to investigate feasibility of determining its mass based on a designed reasonable trajectory. Accounting for several error sources and estimating configurations, the mass can be determined within 20% accuracy by a least-suqares fit process. This work is implemented by using our own software tools WUDOGS (Wuhan University Deep-space Orbit determination and Gravity recovery System).

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