On the Possibility that 2016 HO3 Kamo'oalewa was a Piece of the Moon*

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Abstract. 2016 HO3 Kamo'oalewa is a small body (40 - 100 m) with a trajectory classified as an Earth quasi-satellite. Its orbit is similar to the Earth's, with almost the same semi-major axis, an eccentricity of 0.1, and an inclination of about 8 degrees. Analysis of its spectrum suggests a silicate-based composition. However, its reddening is higher than the typical values found in inner solar system asteroids, indicating a long space weathering. Lunar-like silicates presented the best match compared to the spectrum of material analogs. Therefore, from the spectral analysis, one might suggest Kamo'oalewa is a piece of material originating from the Moon. The current work explores the dynamical aspects of such a possible origin. Considering the case of a small piece of material being ejected from the Moon, we performed numerical simulations of its orbital evolution in the Earth-Moon system around the Sun. A wide range of initial conditions in position and ejection velocity vector around the Moon was investigated. Our analysis indicates that Earth's quasi-satellite trajectories are among the outcomes, and in these cases, the bodies can remain as quasi-satellites for several hundred years. A deep analysis of the conditions necessary to produce suitable ejections from the Moon's surface is under study.

Keywords: The Moon · co-orbital · quasi-satellite.

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