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Project Title

Light Curve and Orbital Analysis of Amor Asteroid 2000NF5

Abstract

Objectives/Goals

The purpose of this project was to investigate the physical parameters and orbital properties of the NEA 2000NF5 to ascertain whether it would be a suitable target for an asteroid spacecraft mission in the near future.

Methods/Materials

Observations were taken almost nightly from 9.14.10-11.13.10 in 80s exposures through V bands. After subtracting bias and flat frames, astrometry was done using stars from the USNO A2.0 catalog in a least squares plate reduction. 3 points were used in a Gaussian orbit determination using the 4th expansion of f and g series. Orbital data of 2000NF5 was run through Swift.RMVS3 to assess precession in the next 200Myr. Photometric data was obtained using reference stars in USNO A2.0 and standard Landolt THPE stars taken on the same night. Corrections for phase angles, nightly extinction, and air mass were applied. A light curve was plotted using 323 points.

Results

The asteroid 2000NF5 has a semi-major axis of 2.21 AU, eccentricity of 0.441, inclination of 1.31°, longitude of ascending node of 282.5°, argument of perihelion of 8.9°, and time of perihelion passage of 2455364.6637 JD. Its rotational period is 59.3h with amplitude of 0.8137, and absolute magnitude of 16 yields a diameter estimate of 1.68-3.75 km.

Conclusions/Discussion

NF5 is a slow rotator which also happens to be sizable, traits both desirable for spacecraft missions. The low inclination of this orbit and its mars-crossing nature suggests 2000NF5 to be accessible. If we follow the triaxial ellipsoid model with axis a, b, and c (a > b > c) and assume it to be rotating about axis c, since that would be most stable, the axis ratio a:b is found to be 2.116 if we ignore variations in amplitude due to phase change,suggesting that NF5 has a highly elongated shape which may prove problematic. However this is assuming both the model and an assumed uniform albedo is correct. This asteroid has a volatile orbit due to mean-motion resonance with Jupiter in the 2/7 Kirkwood gap, and therefore it is likely that NF5 will either be flung into the Sun or out of the solar system. This is however not for millions of years. In conclusion; 2000NF5 appears to have potential as a future target for spacecraft missions, particularly those directed towards Mars, due to its Mars crossing orbit, slow rotation and size; however, much more data must gathered: NF5 has not yet been named nor is its SMASII class known and these must be determined.

Summary Statement

To plot the photometric light curve of asteroid 2000NF5, determine its orbit and changes in orbit due to mean-motion resonance, and ascertain whether it is a suitible candidate for spacescraft missions.

Help Received