

Orbital Determination for Near-Earth Asteroid 2000 YJ66 Using the Method of Gauss

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Abstract

Asteroid collisions with Earth pose a significant threat to human settlements; even tiny asteroids can hit the Earth with enough force to level cities. To predict and mitigate this destruction, astronomers catalog and track near-Earth asteroid orbits. This paper first determines the orbital elements of the near-Earth Asteroid 2000 YJ66 utilizing the Method of Gauss on ground-based telescope observations taken over the course of several weeks, from 2021-06-28 to 2021-07-16. These calculated orbital elements are as follows: a : 2.33441 AU, e : 0.45345, i : 5.69112 deg, ω : 48.66737 deg, Ω : 308.89484 deg, Mean Anomaly for 2021-07-24 @ 07:00 UT: 338.61534 deg. Next, it describes error distributions for each orbital element computed using Monte Carlo simulations and finds that ephemerides generated using these elements differ slightly from JPL Horizons' previously calculated ephemerides, likely due to orbit perturbations introduced by proximity to Earth or Mars. Finally, it uses the Southwest Research Institute's SWIFT program to simulate the evolution of 2000 YJ66's orbit over 50 Myr: finding that it may experience a wide variety of fates but will almost certainly escape from the Solar System or collide with the Sun in that time. These results indicate that 2000 YJ66 is very unlikely to collide with the Earth despite its orbit's high instability.