Observation Plan for (101955) Bennu Using Astronomical Parameter Computations

Zheng, Yuhan (School: Premier School Affiliated to Hou Kong Middle School)

Asteroid observation is vital for gathering lightcurve data, enabling the refinement of asteroid models, reconstruction of their three-dimensional shapes, and derivation of astrophysical properties. This study introduces a computational method to pinpoint optimal observation windows for asteroids with incomplete lightcurve data, demonstrated with (101955) Bennu. Three parameters guide the timing: phase angle (= 30° for sufficient illumination and visibility), elongation (= 90° to avoid sunlight interference), and PABS latitude (targeting missing data intervals). Using Bennu's orbital elements, I converted coordinates into a Cartesian system with the Sun at (0, 0, 0), calculated vectors among the Sun, Earth, and asteroid, and determined phase angle and elongation over time. Statistical analysis of PABS latitude coverage identified gaps at [-15°, -5°] and [5°, 15°], ensuring data replenishment. Results reveal observable periods from 2024-05-12 to 2024-06-22, from 2030-05-14 to 2030-07-03, from 2036-05-26 to 2036-07-12, from 2042-06-10 to 2042-07-24, and from 2043-02-28 to 2043-03-12, where conditions align and PABS intervals are filled. This innovative, parameter-efficient method enhances lightcurve data collection, supporting comprehensive shape modeling. Simplifying observation planning provides enriched datasets for astrophysical research and fundamendal asteroid features for future mission planning to target asteroids like Bennu.

Awards Won: