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Peer Review

Review of: "Measuring the Distances to Asteroids from One Observatory in One Night with Upcoming All-Sky Telescopes"

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This paper explores a method for rapidly determining the distance of near-Earth asteroids (NEOs) using a single observatory on a single night. The topocentric parallax technique, which uses the Earth's rotation to detect small variations in the asteroid's position, is refined and tested. The authors apply the method to synthetic data and to real observations of two asteroids, achieving remarkable accuracy. They also simulate scenarios with future telescopes such as the Vera Rubin Observatory and the Argus Array, demonstrating the potential for determining distances with high accuracy during sky survey operations. The study emphasizes the importance of improving astrometric measurements to increase the accuracy of distance estimates, contributing to planetary defense strategies and space exploration. The research also discusses other complexities and related approaches to measuring distances with parallax, including the use of multiple telescopes and archival data from the Hubble Space Telescope.

The article is, in my opinion, well-written and interesting. I have some minor suggestions, which are outlined below, that I hope could be helpful. Overall, I believe that it is a very interesting piece of work that deserves to be published on Qeios.

1. **Consider air mass contamination:** One way to improve astrometric accuracy, and therefore distance accuracy, is to schedule observations of the asteroid with low air mass. When the air mass is high, the light from a NEO is dimmed/distorted due to atmospheric distortion, scattering, and interference. At the same time, the distance is best constrained when there is a variety of hour angles, preferably night-zenith. Therefore, one must balance high/low air mass

 doi.org/10.32388/XIZY3V

considerations with the need for a variety of hour angles. Perhaps some considerations on this subject could be added to the article.

2. **Addressing tracking:** Tracking (or blurring) caused by closer NEOs, which appear as long streaks in images, increases astrometric uncertainties and complicates NEO detection and tracking. This astrometric uncertainty degrades the signal-to-noise ratio and makes it difficult to identify and detect light from distant objects. Several papers use synthetic tracking, stacking multiple short-exposure images at short time intervals in quick succession to establish the predicted trajectory of fast-moving objects. This technique allows for the removal of tracking loss and improves the detection of faint, fast-moving NEOs. Perhaps this could be briefly discussed in the paper.
3. **Combine with other techniques:** This approach can be combined with other rapid distance techniques for optimal distance determination. Perhaps the method could be used in combination with radar observations for the closest NEOs to independently check its reliability. A comparison of the outcome provided by the two methods could help in assessing the validity of the parallax approach, in my opinion.
4. **Ceres status:** On page 9, it is stated that Ceres is an MBA. Since 2006, after a decision from the IAU, Ceres is considered a dwarf planet. I would suggest editing the text.

Declarations

Potential competing interests: No potential competing interests to declare.