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A New Approach to Estimating Asteroid Diameters From WISE/NEOWISE Observations

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1. Abstract

We present an open, transparent and reproducible framework for analyzing WISE data and estimating asteroid diameters with multiple asteroid thermal models is presented. The models include the Near Earth Asteroid Thermal Model (NEATM), the Fast Rotating Model (FRM) and others. Each step in the data analysis is documented, allowing easy replication, or straightforward extension to other models, including thermophysical models. This framework is potentially useful for any user of WISE data.

2. Introduction

In most previous modeling efforts, a minimum chi-squared fitting method is used, but this requires accurate knowledge of the per-observation errors. With respect to models like NEATM that assume a spherical asteroid, the per-observation error includes lightcurve variations, which are unknown a priori. Bootstrap resampling provides a better method for estimates of the uncertainty in model estimates. We present results for multiple models and identify the most favorable fit according to the corrected Akaike information criterion for model selection. This work includes asteroids with extreme values of the NEATM beaming parameter η. Additionally we model asteroids that are candidates for being fast rotators or tumblers. Some asteroids presented in this work show evidence of emissivities (ε_3, ε_4) not equal to 0.9.

3. Summary and Conclusions

Diameter results are obtained for thousands of the best observed asteroids, including many not previously analyzed by the NEOWISE team. Results are compared to NEOWISE, AKARI, radar, occultation and in-situ values. Interesting examples are highlighted.