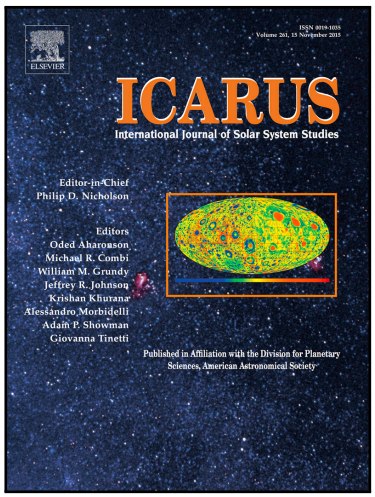

Asteroid thermal modeling in the presence of reflected sunlight

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Highlights:

- A new derivation of the NEATM with reflected sunlight is presented, along with a new fitting methodology.
- Kirchhoff's law of thermal radiation affects thermal modeling when IR bands contain reflected sunlight.
- The NEATM and other models can be parameterized to avoid dependence on visible absolute magnitude H.
- The widespread use of emissivity $\epsilon = 0.9$ is not justifiable on the basis of laboratory spectra of meteorites or silicate minerals.
- Deviations caused by $\epsilon \neq 0.9$ in the W3, W4 bands, or $W3 \neq W4$ can cause errors in diameter estimates that, in certain cases, could exceed 30%.
- A failure to enforce Kirchhoff's law resulted in some inaccuracy in the diameter estimates made by NEOWISE. Taken across a simulated population of asteroids the errors are negligible in some cases but significant in others.
- Kirchhoff's law violation in NEOWISE models leads to systematic errors in diameter estimates between asteroids when applied to sub-populations such as the asteroids in the lowest or highest deciles for near-IR emissivity (or equivalently highest and lowest deciles for near-IR albedo).