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A Physical Model for Cometary Nuclei and Asteroids

DANIEL C. BOICE
Southwest Research Institute, San Antonio, TX USA 78238

A versatile model has been developed that represents the three-dimensional shape and surface properties of cometary nuclei and asteroids and consistently simulates the aspects of illumination, thermal emission, rotational state, and gas production (when volatiles are present) [1]. The geometrical model approximates a triaxial ellipsoid by a large number of triangular patches that can be modified to add surface features, such as craters, mounds, mesas, plains, and other features. The physical model allows arbitrary illumination and viewing angles with shadowing and scattering properties that may vary over the surface. By considering the energy balance at each surface patch, temperatures and sublimation rates are found which are integrated to yield total thermal emission and gas production. Applications of the model to asteroids [216 Kleopatra and 951 Gaspra] and comets [C/1995 O1 (Hale-Bopp), 19P/Borrelly, 9P/Tempel 1, and 10P/Tempel 2] are presented. The model is useful for planning spacecraft encounters with small solar system objects and for analyzing observations and in situ measurements of these bodies from spacecraft when available [2, 3, 4, 5].

Keywords: Comets – Nuclei; Comets - Surface Properties; Asteroids – Surfaces

Reference

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