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# A Model of Comet Dust Based on Integrated Remote-Sensing Data

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We analyze remote-sensing data that describe generic observational properties of comet dust. Our analysis summarizes the results of comet-dust photometry, polarimetry, and thermal-infrared spectroscopy. Using computer simulations with a variety of light-scattering codes, we model typical observational characteristics of comet dust in the visible, such as their low albedo, red color, forward- and back-scattering brightness surge, negative polarization at small phase angles, and positive spectral gradient of polarization. We show that a model of comet dust as large ballistic aggregates of submicron particles provides the best fit to all of the generic observational data. This model is consistent with properties of IDP (interplanetary dust particles) of cometary origin and in-situ measurements of comet dust. Computer simulations of comet thermal infrared spectra allow us not only to confirm this model but also to show that the observed difference in comet infrared characteristics (e.g., weak or strong silicate feature) results from different porosity of the comet dust particles. We integrate the analysis of the optical and infrared data together with their dynamical and evolutional characteristics. We show that comets, whose dust is characterized by particles of rather low porosity, are usually old periodic comets with small values of their semi-major axis. We conclude that compactness of their dust indicates that the particles originate from a mantle of processed comet refractory on the surface of the nuclei. This was confirmed by the ground-based observations of the Deep Impact. Namely, before and some days after the impact, comet Tempel-1 showed very weak silicate feature, typical for mantle-covered nuclei, whereas right after the impact the infrared spectra showed a distinct silicate feature, typical for low-processed comet dust that was expected to be excavated from the nucleus interior by the impactor.