The combined SOHO-STEREO dataset: Simultaneous observations of comets from multiple vantage points

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The set of comets observed by Solar and Heliospheric Observatory (SOHO) and Solar-TErrestrial RElations Observatory (STEREO) provides a large (>2500 comets) and unique database for studying cometary properties. Sungrazing comets are discovered in SOHO or STEREO images on average every few days, with individual comets typically observable for up to a few days. We compiled photometry of more than 20 comets observed simultaneously by the same telescope and filter on both STEREO spacecraft to construct the first dust scattering phase function ever directly computed from simultaneous observations of the same object from two vantage points, thus removing uncertainty caused by changing heliocentric distance between observations. The collective dust scattering phase function spans phase angles from 28–153 deg and agrees reasonably well with the theoretical curve from [1]. However, individual comets deviate from the predicted curve by varying amounts during their apparition. This may suggest that the dust properties of individual comets change on the timescale of hours due to the dramatically different heliocentric distance or that the number of dust grains in the coma is changing due to nucleus activity, rotation, and/or erosion. We have also begun a study of the dust tails of selected well-observed comets in our database. This project utilizes the 3-D aspects of the combined SOHO and STEREO dataset to constrain the dust properties and time of release better than is possible with observations from a single location. We will present ongoing results of these investigations and place them into the wider context of sungrazing comet studies, notably by comparison with SOHO and STEREO observations of comet C/2012 S1 ISON [2], the most extensively observed sungrazing comet in history.

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References: [1] Marcus, J.N. (2007). Forward-Scattering Enhancement of Brightness. I. Background and Model. ICQ, 29, 39–66. [2] Knight, M.M., Battams, K. (2014). Preliminary Analysis of SOHO/STEREO Observations of Sungrazing Comet ISON (C/2012 S1) Around Perihelion. ApJ, 782, L37, (5pp).