

Phase Angle Effects on Sungrazing Comets Observed By SOHO

Matthew M. Knight¹, Michael F. A'Hearn¹, Doug A. Biesecker², Guillaume Faury³, Doug P. Hamilton¹, Philippe Lamy³, and Antoine Llebaria³, ¹University of Maryland, College Park, MD, USA, ²NOAA, Boulder, CO, USA, ³Laboratoire d'Astronomie Spatiale, Marseille, France

Unlike most comets seen at larger heliocentric distances, sungrazing comets seen near perihelion are often observed over a wide range of phase angles in a short time. The phase angle of the Marsden group comet C/1999 U2 changed by nearly 120° over ~ 37 hours. Furthermore, many are seen at high phase angles where forward scattering is very important. The few comets that have been seen at large phase angles, including C/1976 V1 West, 96P/Machholz 1, and C/2006 P1 McNaught, have shown dramatic brightening. Studies by Kolokolova et al. [1] and Marcus [2] have quantified the phase dependence of brightness due to scattering off dust in the coma, showing a gentle increase due to backscattering (phase angle $< 30^\circ$), a strong forward-scattering surge (phase angles $> 100^\circ$), and a relatively flat curve in between.

We apply phase corrections based on the work by Kolokolova et al. [1] and Marcus [2] to the lightcurves of the Kreutz, Marsden, Kracht, and Meyer comet groups which account for more than 90% of all comets observed by SOHO. Unsurprisingly, the phase effect is seasonal, varying with the geometry of each group. Depending on when they reach perihelion, phase angle affects the apparent slope of the brightening and fading, the apparent time and heliocentric distance of peak brightness, and even the detectability for comets near the limiting magnitude of SOHO. We correct the SOHO discovery rates and analyze how accounting for phase changes the size distributions (and thus the implied total masses) of the sungrazing families. We also investigate the implications of the phase angle difference between comets observed by SOHO and the STEREO-A and B satellites in the discovery statistics.

This research was supported by NASA Planetary Atmospheres grant NNG06GF29G.

References

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