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Pre- and Post-equinox ROSINA production rates calculated using a realistic empirical coma model derived from AMPS-DSMC simulations of comet 67P/Churyumov-Gerasimenko

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We have previously used results from the AMPS DSMC (Adaptive Mesh Particle Simulator Direct Simulation Monte Carlo) model to create an empirical model of the near comet coma (<400 km) of comet 67P for the pre-equinox orbit of comet 67P/Churyumov-Gerasimenko. In this work we extend the empirical model to the post-equinox, post-perihelion time period. In addition, we extend the coma model to significantly further from the comet (~100,000-1,000,000 km). The empirical model characterizes the neutral coma in a comet centered, sun fixed reference frame as a function of heliocentric distance, radial distance from the comet, local time and declination. Furthermore, we have generalized the model beyond application to 67P by replacing the heliocentric distance parameterizations and mapping them to production rates. Using this method, the model become significantly more general and can be applied to any comet. The model is a significant improvement over simpler empirical models, such as the Haser model. For 67P, the DSMC results are, of course, a more accurate representation of the coma at any given time, but the advantage of a mean state, empirical model is the ease and speed of use.

One application of the empirical model is to de-trend the spacecraft motion from the ROSINA COPS and DFMS data (Rosetta Orbiter Spectrometer for Ion and Neutral Analysis, Comet Pressure Sensor, Double Focusing Mass Spectrometer). The ROSINA instrument measures the neutral coma density at a single point and the measured value is influenced by the location of the spacecraft relative to the comet and the comet-sun line. Using the empirical coma model we can correct for the position of the spacecraft and compute a total production rate based on the single point measurement. In this presentation we will present the coma production rate as a function of heliocentric distance both pre- and post-equinox and perihelion.