Geophysical Research Abstracts
Vol. 16, EGU2014-6105-1, 2014
EGU General Assembly 2014


# A finite-rate chemistry model for using in-situ gas composition measurements within a cometary diamagnetic cavity as a remote sensing tool for studying volatile materials on the nucleus surface

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If everything goes according to plan, Rosetta will rendez-vous with comet 67P/Churyumov-Gerasimenko in May 2014 and will, among other objectives, study the physicochemical evolution of the cometary coma from onset of activity at large solar distances through perihelion at 1.2 AU. The Rosetta Orbiter Spectrometer for Ion and Neutral Analysis (ROSINA) allows the determination of both neutrals and positive ions in the coma.

In situ gas density and composition measurements within the diamagnetic cavity at a certain distance from the nucleus can be used to obtain estimates of particle densities throughout the cavity, as well as give an estimate of the outgassing rates and volatile material composition at the nucleus surface. This is an inverse problem that has been implemented using a finite-rate chemistry model. It requires knowledge of the solar UV flux, the outgassing flow field, and the chemical reactions that transform the neutral gas as it expands outward (e.g. photo-ionization). In this way, in situ measurements in the coma can be used as a remote sensing tool for studying nucleus surface composition. This will be compared to the “ground truth” provided by the instruments on the Philae lander.

This contribution will explain the finite-rate chemistry model used and illustrate the data inversion technique. Attention is paid to the opportunities and limitations of the proposed technique.