

Chemical and Hydrodynamical Models of Cometary Comae

Steven Charnley

Astrochemistry Laboratory, NASA Goddard Space Flight Center, Greenbelt, USA

Multi-fluid modelling of the outflowing gases which sublime from cometary nuclei as they approach the Sun is necessary for understanding the important physical and chemical processes occurring in this complex plasma. Coma chemistry models can be employed to interpret observational data and to ultimately determine chemical composition and structure of the nuclear ices and dust. We describe a combined chemical and hydrodynamical model [1] in which differential equations for the chemical abundances and the energy balance are solved as a function of distance from the cometary nucleus.

The presence of negative ions (anions) in cometary comae is known from Giotto mass spectrometry of 1P/Halley. The anions O^- , OH^- , C^- , CH^- and CN^- have been detected, as well as unidentified anions with masses 22-65 and 85-110 amu [2]. Organic molecular anions such as C_4H^- and C_6H^- are known to have a significant impact on the charge balance of interstellar clouds and circumstellar envelopes and have been shown to act as catalysts for the gas-phase synthesis of larger hydrocarbon molecules in the ISM, but their importance in cometary comae has not yet been fully explored. We present details of new models for the chemistry of cometary comae that include atomic and molecular anions and calculate the impact of these anions on the coma physics and chemistry of the coma.

[1] Rodgers, S.D., Charnley S.B., Boice, D.C. & Huebner, W.F. (2004), in *COMETS II*, Eds. Festou, M., Keller, H.U. & Weaver, H.A., University of Arizona Press, 505-522

[2] Rodgers, S.D. & Charnley, S.B. 2002, *MNRAS*, 330, 660.

[3] Chaizy, P. et al. 1991, *Nature*, 349, 393.