EGU21-4043
https://doi.org/10.5194/egusphere-egu21-4043
EGU General Assembly 2021

Ion bulk speeds and temperatures in the diamagnetic cavity of comet 67P

Sofia Bergman[1,2], Gabriella Stenberg Wieser[1], Martin Wieser[1], Fredrik Leffe Johansson[3], Erik Vigren[3], Hans Nilsson[1], Zoltan Nemeth[4], Anders Eriksson[3], and Hayley Williamson[1]

[1]Swedish Institute of Space Physics, Kiruna, Sweden (sofia.bergman@irf.se)
[2]Department of Physics, Umeå University, Umeå, Sweden
[3]Swedish Institute of Space Physics, Uppsala, Sweden
[4]Wigner RCP, Budapest, Hungary

The formation and maintenance of the diamagnetic cavity around comets is a debated subject. For active comets such as 1P/Halley, the ion-neutral drag force is suggested to balance the outside magnetic pressure at the cavity boundary, but measurements made by Rosetta at the intermediately active comet 67P/Churyumov-Gerasimenko indicate that the situation might be different at less active comets. Measurements from the Langmuir probes and the Mutual Impedance Probe on board Rosetta, as well as modelling efforts, show ion velocities significantly above the velocity of the neutral particles, indicating that the ions are not as strongly coupled to the neutrals at comet 67P.

In this study we use low-energy high time resolution data from the Ion Composition Analyzer (ICA) on Rosetta to determine the bulk speeds and temperatures of the ions inside the diamagnetic cavity of comet 67P. The interpretation of the low-energy data is not straight forward due to the complicated influence of the spacecraft potential, but a newly developed method utilizing simulations with the Spacecraft Plasma Interaction Software (SPIS) software makes it possible to extract the original properties of the ion distribution. We use SPIS to model the influence of the spacecraft potential on the energy spectrum of the ions, and fit the energy spectrum sampled by ICA to the simulation results. This gives information about both the bulk speed and temperature of the ions.

The results show bulk speeds of 5-10 km/s, significantly above the speed of the neutral particles, and temperatures of 0.7-1.6 eV. The major part of this temperature is attributed to ions being born at different locations in the coma, and could hence be considered a dispersion rather than a temperature in the classical sense. The high bulk speeds support previous results, indicating that the collisional coupling between ions and neutrals is weak inside the diamagnetic cavity.