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Mean ions speeds in the inner coma of 67P

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Abstract

The ESA Rosetta mission followed comet 67P/Churyumov-Gerasimenko for more than two years witnessing how the cometary activity changed over distances >3.5 AU to 1.24 AU pre- and post-perihelion. Cometary ions generated by photoionization and electron-impact ionization are subject to electromagnetic fields and can be accelerated, deflected (have their trajectories confined) and can also have an oscillatory motion associated with plasma waves. At the same time, ion-neutral interactions act to interrupt ion acceleration along electric fields and to move the guiding centre of the ion's gyromotion. Knowing the mean ion velocity is relevant to test our understanding of the various processes at play in the cometary coma. Deriving the mean ion velocity from observations is, however, not straightforward with a highly negativity charged spacecraft that causes acceleration of ions towards the spacecraft. Here we combine data from three instruments within the Rosetta Plasma Consortium (RPC) - the dual Langmuir Probe (LAP), the Mutual Impedance Probe (MIP) and the Ion Composition Analyzer (ICA) - to set constraints on the mean ion velocity at the Rosetta location for different heliocentric- and cometocentric distances. From the present analysis we cannot distinguish ion drift motion from thermal/oscillatory motion.