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Hybrid Plasma Simulations at 67P/Churyumov-Gerasimenko: Predictions for the High Activity Phase

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Abstract

In August 2014 the Rosetta spacecraft will arrive at its target comet 67P/Churyumov-Gerasimenko. One of the main objectives of this unique mission is to study the evolution of the cometary activity. Among others, the instruments of the Rosetta Plasma Consortium will study the plasma interaction of the solar wind and the awaking comet. Since the gas production rate of the comet is relatively low, the kinetic effects of the ion motion are important for the entire interaction region. A hybrid model, which treats the ions as particles and the electrons as a fluid, is most capable of making predictions about the interaction. The results of our latest 3D global hybrid simulations of the plasma environment in the active phase of the comet, performed with the A.I.K.E.F. code, will be presented.

Next to the perihelion passage of the comet the gas production rate will be high enough for the Mach cones, which are triggered during the weak activity phases, to be transformed into a bow shock. Close to the nucleus, the simulations reveal a separation of the massloaded flow from the upstream regions and the pure cometary ion flow from the inner most region. According to this flow pattern, a diamagnetic cavity and several other features are resolved by our simulations. Most of them exhibit an asymmetry caused by the pick-up of the cometary ions and the deflection of the solar wind. In addition, we will show that cometary ions, which are picked-up by the solar wind, enter the transition region and move into opposite directions of the bulk flow.