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Diamagnetic cavity at comet 67P/Churyumov-Gerasimenko: plasma characteristics and dynamics

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The flux gate magnetometer under the Rosetta plasma consortium (RPC-MAG) onboard the Rosetta orbiter identified a large number of unmagnetized plasma regions around the expanding cometary ionosphere of the comet 67P/Churyumov-Gerasimenko. The coupling between the cometary plasma and neutral gas through ion-neutral and electron-neutral collisions leads to these “diamagnetic cavities” within which the solar wind magnetic field cannot penetrate. In the present work we will study the electron density measurements from the mutual impedance probe (RPC-MIP) to characterize the structure and dynamics of these unmagnetized inner cometary plasma regions. It is observed that these are particularly homogeneous, compared to the highly dynamical magnetized plasmas observed in adjacent magnetized regions. Moreover, during the crossings of multiple, successive diamagnetic regions over time scales of tens of minutes to hours, the plasma density is almost identical in the different unmagnetized regions, suggesting that these unmagnetized regions may be a single diamagnetic structure crossed several times by Rosetta. About 15% of the unmagnetized plasma regions are found to be characterized by dynamic plasma enhancements over the stable background neutral gas variation. Detailed analyses on the plasma characteristics of the diamagnetic cavities and the plasma enhancements within them will be presented in the paper.