Energy and momentum flux around comet 67P throughout the Rosetta mission

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We calculate the momentum and energy flux of ions measured by the Ion Composition Analyzer (ICA) on the Rosetta mission at comet 67P/Churyumov-Gerasimenko. We find that the total ion energy and momentum flux stay roughly constant over the mission, but the relative contribution of solar wind ions and cometary ions changes drastically depending on the spacecraft position in the ionosphere and distance from the comet to the sun. We also see that the magnetic pressure, calculated from the magnetic field measured by the Rosetta magnetometer, is on the order of the total ion momentum flux and roughly corresponds with the cometary ion momentum flux. Near both the beginning and end of the mission, solar wind momentum and energy flux are roughly two orders of magnitude larger than the corresponding heavy cometary ion fluxes. When the spacecraft enters the solar wind ion cavity near the comet’s periapsis, the solar wind energy and momentum flux drop drastically, mainly due to reduced density. Meanwhile, the cometary energy flux increases to be roughly equal to the solar wind flux earlier in the mission and the cometary momentum flux as measured by ICA becomes roughly an order of magnitude higher than previous and later solar wind fluxes. We also examine the changes in flux on two excursions, one on the dayside and one on the nightside of the comet, and see that during the nightside excursion, the cometary ion fluxes drop off roughly with the square of the distance from the comet. During the dayside excursion the flux was approximately constant, indicating that the excursion distance was small compared to the region where the observed ions were produced. ICA does not measure the lowest energy ions, so we also discuss the energy and momentum of the full ion population based on density estimates from the LAP and MIP instruments.