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Impact of co-rotating interaction regions on comet 67P

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Co-rotating interaction regions (CIRs) are large-scale solar wind structures that consist of compressed plasma region between fast and slow solar wind. CIRs can drive geomagnetic storms and substorms when they interact with Earth's magnetosphere but their effects on comets are not well-understood.

The Rosetta spacecraft provided in situ observations of the plasma environment of comet 67P/Churyumov-Gerasimenko (67P) that has enabled us to study the complex interaction between the cometary and solar wind plasmas.

In this study we are focusing on four CIR interaction periods with low activity cometary plasma environment between June 2016 and September 2016. The distance of the comet from the Sun was 3.1 to 4.0 AU during the studied interval.

To estimate the CIR impact on the cometary plasma, "quiet time" plasma reference level is estimated. The plasma environment is normalized with respect to cometary latitude and longitude and distance of Rosetta from the comet. We observe huge cometary plasma density increases during CIR impacts as well as enhanced energetic electron fluxes. The enhancement of the plasma density during CIR intervals over the quiet time reference level can be attributed to the enhanced electron-impact ionization due to energetic electron flux enhancement.

We compare the solar wind density variations during CIRs with the ionizing electron fluxes measured by the Rosetta Plasma Consortium/ Ion and Electron Sensor (RPC-IES) and we discuss the possible origin of the energetic electrons near the cometary nucleus during the events.

The CIR (i.e. solar wind) properties at the orbit of comet 67P are estimated using measurements from 1 AU that are propagated using the TAO 1D MHD model. The propagated parameters at Rosetta orbit are validated using solar wind proton velocity, temperature and density that are extracted from the RPC-IES measurements.