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Magnetic holes at comet 67P

Ferdinand Plaschke (1), Tomas Karlsson (2,1), Charlotte Götz (3), Christian Möstl (1), Ingo Richter (3), Martin Volwerk (1), Anders Eriksson (4), Etienne Behar (5), and Raymond Goldstein (6)

(1) Space Research Institute, Austrian Academy of Sciences, Graz, Austria (ferdinand.plaschke@oeaw.ac.at), (2) Department of Space and Plasma Physics, School of Electrical Engineering and Computer Science, Royal Institute of Technology, Stockholm, Sweden, (3) Institute of Geophysics and Extraterrestrial Physics, Braunschweig Institute of Technology, Braunschweig, Germany, (4) Swedish Institute of Space Physics, Uppsala, Sweden, (5) Swedish Institute of Space Physics, Kiruna, Sweden, (6) Southwest Research Institute, San Antonio, USA

Solar wind magnetic holes are distinct, isolated depressions of the interplanetary magnetic field. We present observations of such holes by the Rosetta spacecraft deep within the coma of comet 67P/Churyumov-Gerasimenko, between April and May 2015. During these months, the increasing cometary activity facilitated the appearance of the solar wind cavity around the cometary nucleus: Solar wind protons were increasingly excluded from the inner coma and replaced by heavy cometary ions. Even under these conditions, magnetic holes can penetrate the coma. However, they appear processed with respect to their solar wind counterparts, resembling rather magnetic holes downstream of the Earth's bow shock: They may feature bipolar instead of unipolar magnetic field signatures, as well as shifted instead of anti-correlated density enhancements with respect to the magnetic field depressions. Furthermore, magnetic holes are compressed and change their shape due to magnetic field pile-up at the comet. Their scale sizes are large when compared to the solar wind cavity, but comparable to the gyro radii of cometary heavy ions. Hence, they are of kinetic relevance, yet global structures with respect to the cometary environment. This is totally different to magnetic holes at Earth, where they are entirely magnetohydrodynamic, yet local structures with respect to magnetospheric scale sizes.