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Cross spacecraft measurements of the lower hybrid drift waves and electron holes

C. Norgren (1,2), A. Vaivads (1), Y. V. Khotyaintsev (1), and M. André (1)
(1) Swedish institute of Space Physics, Uppsala, Sweden (cecilia.norgren@irfu.se), (2) Uppsala University

The lower hybrid drift waves (LHDW) and electron holes (EH) often form high amplitude electric fields and are commonly observed in different plasma environments. Due to their small size, however, they have both proved challenging for observations studies. We present cross spacecraft measurements of these two phenomena using two of the Cluster satellites from 2007 when they were at electron gyroradius or a few tens of Debye lengths' distance from each other in the magnetotail. We measure velocity, wavelength, potential (which is comparable to the electron temperature in both cases) and investigate the surroundings. The LHDW are found within current layers of about one ion gyroradius thickness, are in form of vortices and are associated with a fluctuating magnetic field due to ExB-drifting electrons. These results are of high importance for the upcoming MMS mission.