A. Vaivads (1), Y. Khotyaintsev (1), A. Retinò (1), M. André (1), G. Stenberg (1), C. J. Owen (2), S. C. Buchert (1), H. Nilsson (3)

(1) Swedish Institute of Space Physics, Uppsala, Sweden
(2) Mullard Space Science Laboratory, Holmbury St. Mary, UK
(3) Swedish Institute of Space Physics, Kiruna, Sweden

Microphysics of reconnection in situ

We present detailed studies of the microphysics of reconnection based on Cluster in situ measurements near the X-region and in the separatrix regions. At the separatrix region we for the first time show that four out of five terms in the Generalized Ohms Law can be directly estimated using Cluster data. We show that the balance between different terms changes on very short spatial scale. While the strongest electric fields within the density cavity of separatrix region are supported by the Hall term jxB, there are regions where electric field is balanced by electron pressure gradient. We also discuss the formation mechanism of the cavity itself. In addition, we show that different regions within separatrix region are associated with different kind of plasma wave activity, particularly around the lower hybrid and plasma frequencies. We show that different type of plasma waves can be used as a remote sensing tool of reconnection process and magnetic connection of field lines on which spacecraft are located. Observations also show temporal signatures inside separatrix regions that can be explained as reconnection rate variations on ion temporal scales. We show several examples of such "micro-FTEs".