



Plasma electron instrumentation for Cross-Scale

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The Cross-Scale mission, proposed for ESA's Cosmic Visions programme, is designed to study fundamental processes that transport, convert or release energy in collision-less plasmas. Recent space plasma physics research has shown that in fundamental plasma physics phenomena such as magnetic reconnection, turbulence and collision-less shocks, processes operating on different scales all participate simultaneously. The mutual interaction of processes operating on different scales is a critical yet little-understood aspect of the phenomena. The Cluster 4-spacecraft mission has been able to explore only one such scale in three dimensions at any one time, for example the time and length scales of ion motion, or the larger scales on which fluid descriptions of the plasma are appropriate. Planned missions such as MMS will begin to address the smallest relevant scale, that on which electron phenomena occur, which requires a new generation of particle instruments capable of very fast measurements. Cross-Scale will simultaneously address all three scales, using up to 12 spacecraft flying in formation in the Earth's magnetosphere and the solar wind. We will review the requirements for electron instruments for Cross-Scale and discuss how the particular constraints of the mission may affect design choices for electron instruments on spacecraft with different roles in the Cross-Scale constellation.