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A "Cosmic Vision" of Multipoint Space Plasma Physics

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The ESA Cluster project has demonstrated the power of multipoint techniques in space plasma physics. Cluster has given the space plasma community a most valuable database that will continue to offer opportunities for many more years. However, most of the instruments and the Cluster science objectives were developed on basis of knowledge from the late 1980:ies and beginning of 1990:ies. Moreover, many science issues discussed during the Cluster planning phase are under debate, not because we have failed, but because nature turned up to be more complex than anticipated. Cluster, by some considered the ultimate cornerstone in magnetospheric physics, has provided much new knowledge, but it has also raised new questions. A number of the questions are of fundamental nature, with applicability to other fields of science as well. To address these new questions and to further our knowledge in space plasma physics ultimately requires multipoint missions. The rational for multipoint is quite simple: the macroscopic world is four-dimensional - space plus time. Relevant scientific questions to be addressed by multipoint missions in the post-Cluster era are for instance: microphysics within reconnection sites, microphysics of acceleration processes, current sheet instabilities, meso- and macro scale energy transfer processes. New multipoint space missions should have more measurement nodes than Cluster. Such a fleet of satellites could be dispersed such that fundamental length scales are covered (inertia, gyro-radius, boundary thicknesses etc). To be realistic and affordable, managing such a fleet of satellites require novel swarm-technologies. Autonomy, adaptability, environmental perception, and "collective intelligence", concepts known from biological systems, has to be introduced in future satellite system architecture. In this way multipoint missions will meet double challenges - new space science as well as novel space technologies.