A brief writeup on the Future Magnetospheric Research
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Magnetospheric research has made important impact on the space, laboratory and fusion plasma research. The Earth's magnetosphere provides a unique collisionless plasma laboratory for studying the fundamental plasma processes, like, magnetic reconnection, Particle acceleration and plasma turbulence on scales which are not feasible in the laboratory and fusion plasmas. Whereas the overall pictures as how these plasma processes generally work is known, thanks to the unprecedented quality of spacecraft data on plasma and fields gathered in the magnetosphere during the past few decades, yet the basic physics at the micro level still remain unclear. The future thrust of the magnetospheric research should be to understand the microphysics of these fundamental plasma process and the coupling of micro and macro-scales. This will form an important input to the space weather studies. Magnetic reconnection is recognized as the most important phenomenon in the initiation and evolution of many processes in nature, including extreme events in geospace. The Earth's magnetosphere is very important in situ laboratory for the exploration of magnetic reconnection and the associated multiscale phenomena. Another key issue is to identify the physical process (es) which can accelerate the electrons to energies of the order of several MeVs. Further to understand the turbulence cascade to shorter scales, one needs to resolve the scales involving ion- and electron-gyroradii or to ion- and electron inertial scales.

To achieve that there is a need to make multi-point measurements in the magnetosphere because the phenomena involve multi-scales. It is very challenging task for the future magnetospheric mission to make high time resolution particle distribution measurements ~ ms or so to resolve the ion- and electron-inertial scale covering energy scales of a few eVs to 100s keV or more. The wave measurement should have the capability to resolve microsecond structures. There should be concerted effort to study the microphysics of these basic phenomena theoretically and by simulation techniques.