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Instrument developments that enables the future solar-system plasma science missions in Japan

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The Japan-US GEOTAIL spacecraft (1992-) has provided us with high quality plasma data that enabled us to study the magnetospheric phenomena from a kinetic point of view. The most impressive thrust that the mission has given to the magnetospheric community is in the direction to realize based on evidence the importance of cross-scale coupling in the collisionless space plasma. The GEOTAIL spacecraft, subsequently by other spacecrafts such as WIND, Polar and Cluster-II, has shown with data that the ion scale dynamics is indeed crucial in the close proximity of the reconnection region in the magnetosphere. To be specific, while the magnetotail reconnection is an MHD scale phenomena as a whole, the ion-scale dynamics plays the key role in the key region embedded at the origin of the large scale jets. This concept has been known but it was really the data that was epoch making. After the arrival of the evidence considerable research effort has been made focusing on this issue, which not only has upgraded our understanding of the reconnection process but also has transformed our research motivation towards a more universal framework. Given the two facts, (1) plasmas in the universe are mostly collisionless, and (2) magnetospheric community is the only one that can make in-situ particle measurements and make evidence-based-inspection of space plasma dynamics truly appreciating that the plasma is collisionless, it is natural that we, united with other communities such as the solar physicists, expand our research goals to the universal understanding of the collisionless space plasma dynamics. Japan's future missions, the Mercury magnetosphere explorer BepiColombo MMO (launch 2012) and the planned Earth magnetosphere mission SCOPE, will have this as one of the top priority objectives. It, on the other hand, implies that there needs full effort put in developing the scientific instruments to reach this ever valuable goal. In this talk, on-going development of the scientific instruments that will bring success to the missions will be reviewed.

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