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Jovian Exploration: toward the largest and strongest plasma object in our solar system

Yasumasa Kasaba[1*]

[1]Tohoku University

Next generation Jovian exploration is now in progress under the international links. The Europa Jupiter System Mission (EJSM) is the international mission mainly promoted by NASA and ESA, which will be launched in 2020's. NASA will provide the Jovian Europa Orbiter (JEO). ESA will provide the Jovian Ganymede Orbiter (JGO). JAXA also try to establish the study of the Jupiter Magnetosphere Orbiter (JMO). This paper summarizes the plasma measurement strategies for next generation.

The most charm point of the Jupiter system is "the largest, strongest, and most complex electromagnetic system just at our neighborhood. The latest knowledge from the terrestrial magnetospheric studies and the past but imperfect investigations of the Jovian system throw the following problems on us:
(1) A fast rotating huge electromagnetic system: How is the rotation energy of the planet carried out to the magnetosphere? How is a huge magnetodisk kept and collapse? How do these electromagnetic couplings with the magnetosphere affects the planet itself?
(2) A natural accelerator for high-energy particles: How is the creation and loss of high-energy particles? How is the unknown quasi-periodic acceleration generated and maintained? How are these acceleration and loss processes affected by inner and outer elements?
(3) The electromagnetic binary system: How does the gas procured from Io's volcanoes rule the structure, transportation, and composition of the magnetosphere? How are the electromagnetic couplings between Jupiter and Galileo satellites with magnetic fields and conductive ionospheric layers? What information will be procured from the exospheres and ionospheres surrounding of Galileo satellites?

We will attack the following techniques toward this 'Nearby high-energy object'. These are strongly investigated in other current and next generation missions:
(1) The first integrated plasma measurements in the Jovian system: Particle measurements with wide-energy coverage from lowest to highest and 3d FOV. Electric and magnetic measurement with sufficient low noise and high sensitivity.
Those elemental issues will be measured with enough time resolution continuously, supported by state-of-art ground system support.
(2) The first multipoint in-situ measurements: To divide the influence from the outside such as solar winds, to investigate the transportations of matters, energies, and information, three spacecraft elements will achieve the multi-point simultaneous observations with optimized orbits.
(3) State-of-art remote sensing: Plasma imaging technologies (energetic neutral atoms, extreme UV, etc.) will be completely adopted.
It will be served to study the surrounding environments of a specific satellite, the strong auroral activities on the footprint of a specific satellite, and the multi-directional plasma imaging tomography.

Those technologies are synchronized with the Mercury mission 'BepiColombo', the planetary EUV telescope mission 'Exceed', the Earth's inner magnetosphere mission 'ERG', and magnetospheric multiscale mission 'SCOPE'. This paper also covers the base concept 'Plasma Universe' which connects those missions, and introduce the road map to achieve this strategy.

Keywords: Jupiter, Magnetosphere, Spacecraft, Instrumentation