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# NANOSATELLITE CONSTELLATION FOR MEASURING THE TERRESTRIAL PLASMASPHERE STRUCTURE

**Abstract**

New measurement system of the shape of plasmasphere using nanosatellite constellation is presented. The plasmasphere is an inner region of Earth's magnetosphere (1000 to 6000 km) consisting of high density and low energy plasmas. Conventionally we use the X-ray imaging method to determine the shape of plasmasphere, which drastically changes during a magnetic storm. We propose a new method which enables to clarify the shape of the plasmasphere using nanosatellite constellation. In this paper, the total concept design, and system design of the nanosatellite constellation are introduced. When the each satellite of constellation receives a linear polarized electromagnetic wave radiated from the same source origin, the direction of the polarization is affected by the plasma dispersion, because the phase velocities of clockwise and anti-clockwise polarized waves along ambient magnetic fields are different in the frequency range around the electron plasma frequency. This is the so-called Faraday rotation effect. Assuming enough precision of time synchronization among the nanosatellites and the detection of their locations and attitudes, the difference of the polarization observed in each satellite provides the datasets of the thickness from the plasmasphere boundary. The linear polarized electromagnetic wave is emitted by the other kind of satellite which has a wire dipole antenna. The length of the wire dipole is 150 m tip-to-tip since the frequency which the miniaturized plasma wave receiver can resolve the phase of plasma wave is up to several hundred kilohertz. Although conventional plasma wave receivers are unsuitable for nanosatellite, microelectronics for mixed-signal circuits makes the miniaturization of the plasma wave receiver possible. The precision of time synchronization needs to be around 10 ns, which can be realized with synchronization with UTC from GPS satellites. There is a trade-off among number of the satellite constellation, resolution of the measurement, data-transfer rate, and the weight budget. We also discuss the trade-off with trajectory plans.