Novel Space Environment Monitor, Instrument, and Space Mission Concepts

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Near-Earth Asteroid Flyby Survey Mission Using Solar Sail

A novel near Earth (NEA) asteroid flyby survey scheme is proposed using solar sailing technology by reducing the orbital angular velocity of the solar sail and keeping the heliocentric distance constant. This realizes the potential for a very fast NEA survey mission of about one year from the time of launch, and could enhance the asteroid discovery rate. This scheme also has the potential for indirectly reducing the potential Earth impact risk by accumulating information about asteroids, as well as directly reducing this risk by utilizing the spacecraft as a kinetic impactor.

Lorentz Force Spacecraft Formation Dynamics

We proposed a spacecraft formation scheme augmented by Lorentz force using the interaction between an electro-statically charged satellite and the Earth's magnetic field to provide a thrust. The orbital dynamics is investigated and the existence of periodic orbits is shown which can be applied for near-future formation flight missions.

Magneto-Plasma Sail (MPS) Space Propulsion System

An MPS (Magneto-Plasma Sail) is a unique propulsion system, which travels through interplanetary space by capturing the energy of the solar wind, which inflates a weak original magnetic field made by a super-conducting coil of about 2-10 m in diameter with an assistance of a high-density plasma jet. From our theoretical estimations, momentum transfer from the solar wind to a spacecraft with a coil is large enough if the plasma source is operated to inflate only the magnetic field away from the spacecraft. Our activities in 2006 are as follows: (a) Sizing (mass, dimension, current, etc.) of the super-conducting coil to produce magnetic field around the spacecraft, (b) Preparation of the experiment facility to measure magnetic field, temperature, current etc. around super-conducting coil.

Monitor system for Space Electromagnetic Environments (MSEE)

The main objective of the MSEE (Monitor system for Space Electromagnetic Environments) is to monitor the electromagnetic disturbances caused by human activities in space. It consists of the small sensor units distributed around the target space. Our main activities on the development of the MSEE in 2006 are as follows: (a) Development of the analogue ASIC containing the differential amplifiers and A/D converters, (b) Simulation study on the location estimation method for each sensor unit.

Wave-Particle Correlator (WPC) Instrument for Spacecraft Observation.

For a practical application of a plasma wave instrument, a direct measurement system of wave-particle interactions is one of the important systems to the space science mission. WPC instrument can observe wave-particle interactions by calculation of the cross correlation functions between obtained waveforms and detected particles onboard. Our designed system is assembled in one FPGA (Field Programmable Gate Array) IC and data calibration and correlation method is programmed in FPGA.

Airship Experiment for Microwave Power Transmission Technology

A flight experiment aiming at exploring the applications of microwave transmission of power and information was conducted. The experiment configuration is composed of a flight system onboard an airship and ground system. Power on the order of several hundreds Watt is transmitted from the flight system, using a flat dish type antenna, onboard an airship at the altitude of approximately 30 m, to the ground system, downward and vertically. The receiving antenna on the ground collects the transmitted power, which is used for charging cell phones, lighting small bulbs, etc. The flight system is remotely controlled through the commands sent from the ground system to the onboard computer.