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Brightenings on IPT and aurora observed by EXCEED

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Abstract

The Sprint-A satellite with the EUV spectrometer (Extreme Ultraviolet Spectroscope for Exospheric Dynamics: EXCEED) was launched in September 2013 by Epsilon rocket. Our EUV spectrometer working in 520-1480 Å is now orbiting around the Earth (954.05 km x 1156.87 km orbit, the period is 104 minutes). We have started a broad and varied observation program for planets. At the first-day observation, EUV emissions from the Io torus (mainly sulfur ions) and aurora (H_2 Lyman and Werner bands) of Jupiter have been identified. Continuous 3-month measurement for Io plasma torus and aurora was performed to witness the sporadic and sudden brightening events occurring on one/both sides.

1. Introduction

A series of small scientific satellites, which ISAS/JAXA has started to develop, based on the concept 'cheaper and faster realization of unique space experiments' as a complementary program of mainstream scientific satellites. ISAS/JAXA has released the plan to launch some small satellites for 5 years. The mass of satellites is approximately 350 kg. This approach allows to significantly reduce the time required to obtain science output. Moreover, the shorter development period can reduce overall costs. ISAS has built standard bus architecture, where the bus and the payload are clearly separated in a modular manner. The series of the spacecraft employing standard bus architecture is named as Small scientific satellite Platform for Rapid Investigation and Test (Sprint-series).

Fifteen working groups to propose small scientific satellites in this category were constituted under the Steering Committees of Space Science and Space Engineering in ISAS. Our EXCEED mission (EXtreme ultraviolet speCtroscope for ExosphEric Dynamics) was one of the proposals and was selected as the first program in 2007[1]. It was based on the technological advances in the EUV spectral range during the past two decades. We have enabled quantitative spectroscopy to provide detailed information on neutral and ionized gases of atmospheric and astrophysical interest. There are several fundamental reasons that technological advances which have opened the EUV spectral range to investigate are important, (1) strong resonance transitions of the most abundant atmospheric and exospheric elements, e.g., hydrogen, helium, and oxygen have emission lines in the spectral range shortward of 1500Å, (2) for solar planets, interactions among solar wind, the magnetospheres, the exospheres, ionospheres, and atmospheres give rise to diagnostic EUV emission on a global scale (Yoshioka et al. 2013; Yamazaki et al. 2003), (3) many of primary astrophysical interaction process occur in the energy equivalent temperature from 10^4 to 10^6 Kelvin, producing transitions in the EUV.

The science instrument (EXCEED) is solely boarded on the SPRINT-A spacecraft built by ISAS/JAXA (Figure1). EXCEED on SPRINT-A is the world's first observatory in space observing planets, Venus, Mars, Jupiter, and Saturn. Spectroscopic imaging in the spectral range of extreme ultraviolet (EUV), which cannot be observed on the ground, allows us to collect information on the planetary atmospheres and magnetospheres. Here we will present the instrumental specifications with in-flight calibration and the initial results of the observations.

2. Observations

On November 19, 01:48:42UT, Jupiter was at a solar elongation of 125 degree and apparent diameter was 43.6 arcsec. We had the first light image. In december we started the nominal observation of IPT and aurona for 3-month. We have identified the simaltaneous (within some time-lag) brightenings on IPT and aurora of Jupiter. The time lag indicates the energy transfer path responsible for the brightening.

Figure 1: EXCEED on Sprint-A

6. Summary and Conclusions

The Sprint-A satellite with the EUV spectrometer (EXCEED) was launched in September 2013 by Epsilon rocket. Our EUV spectrometer working in 520-1480 Å has observed the IPT and aurora of Jupiter during 3-month. We have found some events where the both regions brightened simultaneously. The time lag between them may indicate the penetration path of hot electron (or energy) responsible for emissions.

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