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According to the Korean government's Long-term Space Development Plan 2040, "Creative space science research" is included in a statement to investigate the origin and evolution of the universe by conducting a series of Korean space telescope missions: launch of space telescopes on a small satellite and an international collaboration explorer by 2020, a mid-size domestic space telescope by 2030, and a large size Korea leading international space telescope by 2040. We studied the feasibility of the future Korean Space Telescope (KST) for a mid-size domestic satellite platform. In order to pursue the uniqueness of the science program, we consider a wide range of observing wavelength (0.2um ~ 2.0um) with a spectral resolution of R~6 in the NUV and optical bands, and R~30 for NIR, utilizing an off-axis TMS(Three Mirror System) optics with a wide field of view (2x4 degrees) which is optimized for ultra-low surface brightness sources. The main science goals of the mission include investigations of the galaxy formation, cosmic web, and the cosmic background radiation in the NUV-NIR regions. In this paper, we present the science cases and several technical challenges to be resolved along with the future milestones for the success of the KST mission.

[구 ST-02] Status Report of the Flight Model of the NISS onboard NEXTSat-1

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The NISS (Near-infrared Imaging Spectrometer for Star formation history) is the near-infrared spectro-photometric instrument optimized to the Next Generation of small satellite series (NEXTSat). To achieve the major scientific objectives for the study of the cosmic star formation in local and distant universe, the spectro-photometric survey covering more than 100 square degree will be performed. The main observational targets will be nearby galaxies, galaxy clusters, star-forming regions and low background regions.

The off-axis optics was developed to cover a wide field of view (2 deg. x 2 deg.) as well as the wide wavelength range from 0.95 to 2.5μm, which were revised based upon the recent test and evaluation of the NISS instrument. The mechanical structure were tested under the launching condition as well as the space environment. The signal processing from infrared sensor and the communication with the satellite were evaluated after the integration into the satellite.

The flight model of the NSS was assembled and integrated into the satellite. To verify operations of the satellite in space, the space environment tests such as the vibration, shock and thermal-vacuum test were performed. The accurate calibration data were obtained in our test facilities. Here, we report the test results of the flight model of the NISS.

[구 ST-03] CubeSat Application for Space Astronomy

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인공위성을 이용한 우주망원경 및 우주탐사장비는 천문학 및 우주과학 연구에 매우 중요한 관측 장비로서 지상에서 불가능한 다양한 파장대에서 관측을 수행하고 있다. 이러한 우주망원경의 경우 개발기간과 비용 또한 상대적으로 매우 큰 규모를 가지고 있다. 또한 장시간의 관측을 위한 관측위성의 운영 신뢰도 확보와 결과 활용을 위해 많은 연구 인력이 투입되는 거대 연구개발 사업이다.

그러나 최근에는 초소형 인공위성을 이용하여 여러 우주관측 및 실험이 수행되고 있다. 큐브위성으로 명명되어 있는 초소형 인공위성은 크기와 전력의 제한은 있지만 상대적으로 단기간의 개발일정과 저비용으로 전 세계적으로 폭발적인 성장을 하고 있는 관측기술이다. 경희대학교에서는 CINEMA라는 2개의 큐브위성을 개발 운영하였고, SIGMA 라는 큐브위성을 개발하여 발사를 기다리고 있다. 또한 향 후 광학관측을 위한 초소형 인공위성을 기획하고 있다. 국내에서는 천문우주용으로 제작되는 위성이외에도 다양한 기술검증용 위성이 10여기 이상 제작되고 있는 상황이다. 이에 초소형인공위성의 동향과 향 후 천문우주 관측에 활용 할 수 있는 방안에 대하여 논의 하였다.

[구 ST-04] Small scale magNetospheric and Ionospheric Plasma Experiments; SNIPE mission

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The observation of particles and waves using a single satellite inherently suffers from space-time ambiguity. Recently, such ambiguity has often been resolved by multi-satellite observations; however, the inter-satellite distances were generally larger than 100 km. Hence, the ambiguity could be resolved only for large-scale (> 100 km) structures while numerous microscale phenomena have been observed at low altitude satellite orbits. In order to resolve those spatial and temporal variations of the microscale plasma structures on the topside ionosphere, SNIPE mission consisted of four (TBD) nanosatellites (~10 kg) will be launched into a polar orbit at an altitude of 700 km (TBD). Two pairs of satellites will be deployed on orbit and the distances between each satellite will be from 10 to 100 km controlled by a formation flying algorithm. The SNIPE mission is equipped with scientific payloads which can measure the following geophysical parameters: density/temperature of cold ionospheric electrons, energetic (~100 keV) electron flux, and magnetic field vectors. All the payloads will have high temporal resolution (~ 16 Hz (TBD)). This mission is planned to launch in 2020.

The SNIPE mission aims to elucidate microscale (100 m-10 km) structures in the topside ionosphere (below altitude of 1,000 km), especially the fine-scale morphology of high-energy electron precipitation, cold plasma density/temperature, field-aligned currents, and electromagnetic waves. Hence, the mission will observe microscale structures of the following phenomena in geospace: high-latitude irregularities, such as polar-cap patches; field-aligned currents in the auroral oval; electro-magnetic ion cyclotron (EMIC) waves; hundreds keV electrons' precipitations, such as electron microbursts; subauroral plasma density troughs; and low-latitude plasma irregularities, such as ionospheric blobs and bubbles.

We have developed a 6U nanosatellite bus system as the basic platform for the SNIPE mission. Three basic plasma instruments shall be installed on all of each spacecraft, Particle Detector (PD), Langmuir Probe (LP), and Scientific MAGnetometer (SMAG). In addition we now discuss with NASA and JAXA to collaborate with the other payload opportunities into SNIPE mission.

[구 ST-05] Different Responses of Solar Wind and Geomagnetism to Solar Activity during Quiet and Active Periods

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It is well known that there are good relations of coronal hole (CH) parameters such as the size, location, and magnetic field strength to the solar wind conditions and the geomagnetic storms. Especially in the minimum phase of solar cycle, CHs in mid- or low-latitude are one of major drivers for geomagnetic storms, since they form corotating interaction regions (CIRs). By adopting the method of Vrsnak et al. (2007), the Space Weather Research Center (SWRC) in Korea Astronomy and Space Science Institute (KASI) has done daily forecast of solar wind speed and Dst index from 2010. Through years of experience, we realize that the geomagnetic storms caused by CHs have different characteristics from those by CMEs. Thus, we statistically analyze the characteristics and causality of the geomagnetic storms by the CHs rather than the CMEs with dataset obtained during the solar activity was very low. For this, we examine the CH properties, solar wind parameters as well as geomagnetic storm indices. As the first result, we show the different trends of the solar wind parameters and geomagnetic indices depending on the degree of solar activity represented by CH (quiet) or sunspot number (SSN) in the active region (active) and then we evaluate our forecasts using CH information and suggest several ideas to improve forecasting capability.

[구 ST-06]Lunar Exosphere Simulated with Localized Sources

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We are planning to conduct Monte Carlo simulations for the Na exospheres of the Moon including localized sources on the surface in addition to the global isotropic and anisotropic sources, which were previously studied. The simulation models are based on Lee et al. (2011), who presented a satisfactory interpretation for the isotropic and anisotropic sources of the Lunar Na exosphere. We will compare our preliminary models with existing and the future lunar tail/exospheric observations by the LADEE and