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Very Long Baseline Interferometry (VLBI) at millimeter wavelengths results in the highest angular resolutions achieved in astronomy and has a unique access to emission regions that are inaccessible with any other approach or at longer wavelengths. The simultaneous multi-frequency VLBI system in the Korean VLBI Network (KVN) is considered one of the most effective systems for compensating the atmospheric phase fluctuations, which is particularly bothersome at mm-VLBI. We have been demonstrating its performance and uniqueness at mm-VLBI observations. As a results, international VLBI partners from Japan, China, Australia and EU have expressed their interest on the KVN style simultaneous multi-frequency system. In this talk, we will report the activities for extending the simultaneous multi-frequency system to global VLBI network and introduce its science driver, measuring AGN core-shift effects.

[구 AT-04] Benchmark Results of a Radio Spectrometer Based on Graphics Processing Unit

Jongsoo Kim and Jan Wagner
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We set up a project to make spectrometers for single dish observations of the Korean VLBI Network (KVN), a new future multi-beam receiver of the ASTE (Atacama Submillimeter Telescope Experiment), and the total power (TP) antennas of the Atacama Large Millimeter/ submillimeter Array (ALMA). Traditionally, spectrometers based on ASIC (Application-Specific Integrated circuit) and FPGA (Field-Programmable Gate Array) have been used in radio astronomy. It is, however, that a Graphics Processing Unit (GPU) technology is now viable for spectrometers due to the rapid improvement of its performance. A high-resolution spectrometer should have the following functions: poly-phase filter, data-bit conversion, fast Fourier transform, and complex multiplication. We wrote a program based on CUDA (Compute Unified Device Architecture) for a GPU spectrometer. We measured its performance using two GPU cards, Titan X and K40m, from NVIDIA. A non-optimized GPU code can process a data stream of around 2 GHz bandwidth, which is enough for the KVN spectrometer and promising for the ASTE and ALMA TP spectrometers.

태양계

[구 SS-01] Near-IR Radiative Transfer Process for the Hazy Atmosphere of Titan

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Radiative transfer programs have been developed to simulate near-IR spectra of Titan. The formalism of the radiative transfer calculations includes the absorption and emission lines of CH_4, C_2H_2, C_2H_6, and HCN, and continua produced by Titanian haze particles. Absorption and scattering of sunlight by haze particles are considered by employing a two-stream approximation and a spherical-shell model for the atmospheric layers of Titan. Various constraints on the radiative transfer calculations for generating synthetic spectra will be discussed and presented. Several examples of comparisons between the synthetic spectra and recent spectral observations of Titan will also be presented.

[구 SS-02] KISO/KWFC Observation of the Dust Ejecta Associated with the 2007 Outburst of 17P/Holmes

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The 2007 event occurred at 17P/Holmes is known as the most energetic cometary outburst in the history of modern astronomical observations. At this conference, we report our new observation of the comet one orbital period after the event. We thus made the observation of 17P/Holmes in 2014 September using the Kiso Wide Field Camera (KWFC) attached to the 105 cm Schmidt telescope at the Kiso Observatory. It is known that dust particles are thought to converge on the orbital

plane of the parent body at the opposite end of the dust ejection viewed from the Sun. Similar phenomenon occurs when dust particles complete one orbital revolution (what we call, neck-line structures). We succeeded in the detection of the dust ejecta of the 2007 outburst by means of the neck-line. With the image, we plan to discuss the ejection velocity and the total mass of the ejecta to deepen our understanding of the historical event.

[구 SS-03] Regional variations of optical properties on asteroid (25143) Itokawa taken with the Asteroid Multi-band Imaging Camera (AMICA) on-board the Hayabusa spacecraft

Mingyeong Lee, Masateru Ishiguro
Seoul National University

Hayabusa is the JAXA's space mission that succeeded in sample-return from S-type asteroid (25143) Itokawa. During the rendezvous phase, more than a thousand of images were taken with the Asteroid Multi-band Imaging Camera (AMICA). It is valuable to study the regional variation of the optical properties on the asteroid using these images to know the generality and uniqueness of the returned samples. In addition, AMICA images are important in that they provide unique data set at low phase angle (i.e Sun-Itokawa-AMICA's angle) that have not been explored in the previous asteroidal missions. At the previous conference (2015 KAS spring meeting), we introduced our preliminary data analysis of AMICA data without considering the shape model of Itokawa and mentioned. In this study, we present a new result obtained through further analysis, taking account of the shape model of the asteroid. We thus utilized "plate_renderer" tool to derive Hapke model parameters at different terrains. It is found that the opposition amplitude (parameter B0) is consistent with those of the other S-type asteroids while the opposition width (parameter h) is significantly narrower than those of the other S-type asteroids. At this conference, we plan to describe the regional variation of photometric properties on Itokawa.

[구 SS-04] Fractional contribution of solar system minor bodies to the IDPs complex

Hongu Yang and Masateru Ishiguro
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It is obvious that there are plentiful of dust particles in the interplanetary spaces of the Solar System (IDPs), based on micrometeor craters, zodiacal light and direct measurements on the spacecraft. Because of photon drag and planetary perturbations, these particles are continuously falling to the Sun or planets, therefore continuous source of the IDPs are required.

We studied the fractional contribution of each type of solar system objects to the IDPs complex through the optical properties of the potential dust sources and the zodiacal light. We found that more than 90% of the IDPs are originated from cometary nuclei. This result is discussed through the comparison with the dynamic simulation, micrometeors mineralogy and near-infrared spectrum of the zodiacal light.

In addition, we introduce our new project on the numerical simulation for the dust particles ejected from the cometary nuclei, to verify the conclusion of dominant cometary contribution and its detailed consequences.

[구 SS-05] Maturity of the Crater Rim Walls as a function of the Crater Size

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Space weathering agents such as micrometeoroids and solar wind particles continuously age the uppermost regolith of the lunar surface by comminuting as well as darkening and reddening. Among several maturity indices, we investigate median grain size (<d>) and optical maturity (OMAT) of the crater rim walls. Crater rim wall is the most immature place among the impact crater features because the vertical mixing process by mass-movement can enhance the gardening of regolith and the supply of immature materials in the deeper layer to the surface. More than 140 simple and complex craters were considered. Both <d> and OMAT values of the inner rim wall initially increase as the crater size increases until ~10-20 km, then decrease. This transition crater size happens to correspond to the transition diameter from simple to complex craters. For larger craters, i.e., complex craters, it is clear that the inner rim wall of the craters formed in recent eras tend to remain fresh and become mature along with time. For the simple crater case, smaller craters are more mature, which is opposite to the case of complex craters. This is thought to be because smaller craters become flattened more quickly, thus have smaller vertical mixing in the regolith due to mass-movement. We will also discuss on