magnitude fainter object.

[구 SS-16] Possible Causes for the Temporal Variations of 3-micron Hydrocarbon Emissions in the Auroral Regions of Jupiter

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Recently, temporal variations of the 3-micron emissions of methane and ethane have been detected in the auroral regions of Jupiter observed from Gemini North (Kim et al. 2019, in preparation). These temporal variations of 3-micron hydrocarbon emissions in the auroral regions can be caused by the following phenomena: temporal variations of temperatures, mixing ratios, auroral particle bombardments and Joule heatings, and the combinations of these. Although we are not able to quantitatively determine the cause of the temporal variations at this moment, we will present the following quantitative discussions: thermal influences on the 3-micron emissions, global mixing ratio distributions of the hydrocarbon molecules, and energy distributions of auroral particles penetrating the hydrocarbon layers. We will also present a possible correlation between the temporal variations of the 3-micron emissions and solar wind activities.

[구 SS-17] Polarimetry of the Moon through the eyes of PolCam: Phase-angle coverage

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한국형 시험용 달 궤도선(KPLO)에 실릴 과학 탑재체 가운데 하나인 광시야 편광 카메라(PolCam)는 최초로 달 표면 전체의 편광 특성을 관측한다. 편광 특성은 태양-달-관측기기 사이의 각도인 위상각에 따라 달라지므로, 다양한 위상각에서의 반복 관측을 통해 달 전 지역에 대한 각각의 편광곡선을 얻을 예정이다. 편광곡선으로부터 달 표면의 입자 크기와 성분 등의 분포를 알 수 있다. 이는 과학적으로도 흥미로울 뿐 아니라, 미래의 달 탐사 임무를 위한 착륙지 선정 시에도 중요한 참고자료가 된다. 여기에서는, PolCam이 1년간의 KPLO 임무 동안 관측할 수 있는 지역 및 위상각의 분포를 소개한다. 또한, 임무 도중 관측이 일시중지되거나 임무 자체가 비정상종료되는 경우 불완전한 관측 자료로부터 편광곡선을 구하는 방법에 대해 알아본다.

[구 SS-18] KARI Planetary Data System for Science Research Support in Korea Pathfinder Lunar Orbiter Program

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우리나라 최초의 우주탐사 프로그램인 Korea Pathfinder Lunar Orbiter (KPLO)는 1년의 임무기간동안 달과 달 주변의 우주환경에 대한 과학탐사 임무를 수행할 예정이다. 이를 위해서 1개에 기술 검증장비와 고해상도 카메라를 포함한 5개의 과학장비를 탑재할 예정이다. 이 중 고해상도 카메라인 LUTI(LUnar Terrain Imager)와 국내에서 개발한 3개의 과학탑재체(KGRS;감마선분광기, KMAG;자기장측정기, PolCam;광시야 편광카메라)가 획득한 과학자료는 일정기간(통상 1년)동안 비공개로 검보정이 이루어진 후 일반에게 공개(Public release)할 예정이다. 이러한 과학자료의 공개와 관리를 위해서 한국항공우주연구원은 KPLO 심우주 지상시스템 내에 과학자료의 공개 및 관리를 위한 KARI Planetary Data System(KPDS)을 개발하고 있다. KPDS는 미국 NASA의 PDS에서 개발하여 유럽, 일본 등에서 이미 행성탐사 과학자료의 표준으로 활용하고 있는 PDS4 표준을 준수하는 과학자료를 제공할 것이다. 본 발표를 통해서 KPDS의 운영개념과 과학자료 관리계획, 그리고 KPDS의 개발현황을 천문학계와 공유하여 KPLO에 의해서 획득된 과학자료가 많은 과학자들이 활용하여 높은 과학적 성과를 낼 수 있기를 기대한다.

우주론

[구 CD-01] Second order induced gravitational waves

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We present the second order solutions of the cosmological gravitational waves induced by linear cosmological perturbations.

[구 CD-02] Formation of First Astrophysical Objects under the Influence of Large-Scale Density and Velocity Environment

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We present our first attempt at understanding the dual impact of the large-scale density and velocity environment on the formation of very first astrophysical objects in the Universe. Following the recently developed quasi-linear perturbation theory on this effect, we introduce the publicly

available initial condition generator of ours, BCCOMICS (Baryon Cold dark matter COsMological Inital Condition generator for Small scales), which provides so far the most self-consistent treatment of this physics beyond the usual linear perturbation theory. From a suite of uniform-grid simulations of N-body+hydro+BCCOMICS, we find that the formation of first astrophysical objects is strongly affected by both the density and velocity environment. Overdensity and streming-velocity (of baryon against cold dark matter) are found to give positive and negative impact on the formation of astrophysical objects, which we quantify in terms of various physical variables.

[구 CD-03] Falsifying LCDM: model-independent tests of the concordance model of cosmology

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The concordance LCDM model has been very successful at reproducing a wide range of observations.

However, the nature of its main components, such as dark energy, dark matter, and inflation, are still unkown.

Therefore, it is of prime importance to question the underlying hypotheses of the model and tests there prediction.

While most constraints have been obtained assuming a LCDM universe, model-independent approaches, which do not make assumptions regarding the model, are a powerful approach.

To falsify the LCDM model, I applied model-indepedent methods to the latests available data to test different aspects of the concordance model, such as the FLRW metric, the curvature, dark energy as the cosmological constant, and gravity as general relativity.

The Universe is consistent with flat-LCDM with GR. However, at z>1, tensions start to appear, and more data are required.

[구 CD-04] Cosmological constraints using BAO – From spectroscopic to photometric catalogues

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Measurement of the location of the baryon acoustic oscillation (BAO) feature in the clustering of galaxies has proven to be a robust and precise method to measure the expansion of the Universe. The best constraints so far have been provided from spectroscopic surveys because the errors on the redshift obtained from spectroscopy are minimal. This in turn means that the errors along the line-of-sight are reduced and so one can expect constraints on both angular diameter distance D_A and expansion rate H^{-1}.

But, future surveys will probe a larger part of the sky and go to deeper redshifts, which correspond to more number of galaxies. Analysing each galaxy using spectroscopy, which is a time consuming task, will not be practically possible. So, photometry will be the most convenient way to measure redshifts for future surveys such as LSST, Euclid, etc. The advantage of photometry is measuring the redshift of vast number of galaxies in a single exposure, but the disadvantage are the errors associated with the measured redshifts.

Using a wedge approach, wherein the clustering is split into different wedges along the line-of-sight π and across the line-of-sight σ, we show that the BAO information can be recovered even for photometric catalogues with errors along the line-of-sight. This means that we can get cosmological distance constraints even if we don't have spectroscopic information.

[구 CD-05] H1R4: Mock 21cm intensity mapping maps for cross-correlations with optical surveys

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We are currently living in the era of the wide field cosmological surveys, either spectroscopic such as Dark Energy Spectrograph Instrument or photometric such as the Dark Energy Survey or the Large Synoptic Survey Telescope. By analyzing the distribution of matter clustering, we can use the growth of structure, in combination with measurements of the expansion of the Universe, to understand dark energy or to test different models of gravity. But we also live in the era of multi-tracer or multi-messenger astrophysics. In particular, during the next decades radio surveys will map the matter distribution at higher redshifts. Like in optical surveys, there are radio imaging surveys such as continuum radio surveys such as the ongoing EMU or spectroscopic by measuring the hydrogen 21cm line. However, we can also use intensity mapping as a low resolution spectroscopic technique in which we use the intensity given by the emission from neutral hydrogen from patches of the sky, at different redshifts. By cross-correlating this maps with galaxy catalogues we can improve our constraints on cosmological parameters and to understand better how neutral hydrogen populates different types of galaxies and haloes. Creating realistic mock intensity mapping