Naoyuki Tamura  
(Kavli Institute for the Physics and Mathematics of the Universe, the University of Tokyo)

Title: PFS: The next generation Subaru's facility instrument under integration

Abstract: PFS (Prime Focus Spectrograph), a next generation facility instruments on the Subaru telescope, is a very wide-field, massively multiplexed, and optical & near-infrared spectrograph. 2394 reconfigurable fibers will be distributed in the 1.3 degree-diameter field of view. The spectrograph system has been designed with 3 arms of blue, red, and near-infrared cameras to simultaneously deliver spectra from 380nm to 1260nm in one exposure. The international team under the initiative of Kavli IPMU are actively integrating and testing the hardware and software of the subsystems. After we delivered one of the subsystems Metrology Camera System to the observatory at the summit of Maunakea last year in 2018, we subsequently tested it on the telescope and recently succeeded in demonstrating a part of the fiber configuration process with a pinhole mask illuminated from its behind at the prime focus to mimic the backlit fiber array in the real prime focus instrument for PFS. The development of the other subsystems is also progressing steadily, aiming at starting engineering observation in 2020, and science operation from 2022. In this presentation, I will give an overview of the instrumentation, current status and future perspectives.
Title: PFS SSP survey planning

Abstract: The PFS Science Collaboration team is planning to carry out inter-connected, coherent three science programs, Cosmology, Galaxy Evolution and Galactic Archaeology, with the Prime Focus Spectrograph, under the SSP framework. We envision that we will start our survey from 2022. Here I will describe the survey designs and strategies to achieve the scientific goals.
David Schlegel  
(Lawrence Berkeley National Lab)

Title: **DESI Installation Challenges, First Light, and Survey Plan**

Abstract: The Dark Energy Spectroscopic Instrument (DESI) addressed construction and installation challenges completing its 5000-fiber focal plane and 10 optical spectrographs in 2019. As a dedicated instrument at the Mayall 4-m Telescope at Kitt Peak, it will target 35 million galaxies and quasars over its 5-year survey. First light spectra will be presented. Early survey data is likely to cover the equatorial footprint of the Subaru Hyper Suprime-Cam imaging, enabling synergies between DESI and the Subaru Prime Focus Spectrograph.
Abstract: LSST will provide unprecedented deep imaging of more than half of the sky over the course of its ten-year survey. However, unlike the case for SDSS, there is no corresponding spectroscopic survey currently planned. The PFS spectrograph is uniquely capable of helping to fill this gap. In this talk, I will describe a variety of ways that the combination of PFS and LSST can enable new science. I will particularly focus on the use of PFS spectroscopy to train photometric redshift algorithms, which has the potential to improve dark energy constraints from LSST by ~40%. Similar machine learning-based techniques can be used to label galaxies across the LSST footprint with a wide variety of properties (stellar mass, star formation rate, etc.) using mappings from LSST photometry to match PFS-inferred characteristics for limited training sets. Through such methods, the combination of PFS and LSST can enable a wide variety of new science that neither project could achieve on its own.
Tadayuki Kodama
(Astronomical Institute, Tohoku University)

Title: Revealing the build-up of large scale structures and galaxy populations therein with PFS^2

Abstract: We have been tracing the cosmic large scale structures hosting galaxy clusters/groups since $z=1.7$ to 0.4 with HSC (HSC^2 survey), and constructing a unique sample of recently quenched galaxies (RQGs) along the structures. With a systematic spectroscopic follow-up program with PFS (PFS^2 survey) on the unique samples of rare objects such as distant clusters and RQGs we will investigate the growth of galaxy structures with cosmic times, and unveil the star formation histories of galaxies therein, such as biased galaxy formation and environmental quenching as well as the intrinsic evolution of galaxies related to the mass of the systems.
Title: Why PFS is exciting for fundamental physics

Abstract: The planned survey with Prime Focus Spectrograph on the Subaru telescope will enable comprehensive tests on the current standard paradigm of the evolution of the Universe called $\Lambda$CDM. The paradigm is based on many assumptions: general relativity, flat FRW metric, nearly scale-invariant adiabatic Gaussian perturbation, hierarchical structure formation, cosmological constant, massless neutrinos, and deionization from stellar formation. The PFS survey will challenge all of these assumptions with real data. I believe PFS will provide legacy data for fundamental science of the Universe for decades to come.
Title: ULTIMATE-Subaru: Project Overview and Current Status

Abstract: ULTIMATE-Subaru is a next large facility instrument project at Subaru telescope. We will develop a wide-field near-infrared (1.0-2.5 micron) imager at Cassegrain (Cs) and a multi-object spectrograph at Nasmyth IR (NsIR) with the aid of a ground-layer adaptive optics system (GLAO), which will uniformly improve the seeing over a wide field of view up to ~20 arcmin in diameter. The GLAO system consists of an adaptive secondary mirror (ASM), a laser guide star facility (LGSF), and wavefront sensor systems at NsIR and Cs foci. The expected spatial resolution by the GLAO correction is about 0.2 arcsec FWHM in K-band under moderate seeing conditions at Subaru. In this presentation, we present the overview, current status, and plan for ULTIMATE-Subaru project.
Title: **ULTIMATE prospects for galaxy surveys beyond z=10**

Abstract: I will present a forecast of wide-field galaxy surveys with future near-infrared imaging facilities such as Euclid, WFIRST and Subaru ULTIMATE. Among them, ULTIMATE has a unique K-band imaging capability which is essential to select galaxy candidates at z>11 securely.
Kate Whitaker
(UMass Amherst)

Title: **Tracing the Life Cycles of Massive Galaxies up to Cosmic Noon: Prospects with ULTIMATE-Subaru**

Abstract: In this talk, I will discuss using the wide-field, adaptive optics capabilities proposed for the ULTIMATE-Subaru imaging survey to study the formation of massive galaxies, tracing their emergence at $z \sim 5$ to their rapid growth and demise by $z \sim 1$. In particular, I will discuss lessons learned from previous near-infrared medium-band surveys such as the NEWFIRM Medium-Band Survey and ZFOURGE. Deep, high spatial-resolution rest-optical medium-band imaging from ULTIMATE-Subaru will enable the discovery and census of the first quenching (compact) galaxies. Moreover, it will push our understanding of the build-up for stellar mass as a function of environment to new frontiers. ULTIMATE-Subaru would be a powerful tool to trace galaxy formation and evolution from cosmic dawn to the peak epoch of star formation at cosmic noon, critical time periods with many remaining open questions.
Title: Time domain astronomy with ULTIMATE-Subaru

Abstract: I will overview the time domain science that can be investigated by ULTIMATE-Subaru.
Eric Peng  
(Peking University)

Title: Galaxy evolution in the local Universe with ULTIMATE

Abstract: The combination of wide-field coverage and high spatial resolution provided by ULTIMATE-Subaru will be a powerful tool to study the local Universe. I will present a variety of local science cases for ULTIMATE-Subaru, from the Milky Way to nearby galaxies.
Abstract: The microlensing events toward the inner Galactic center (|b| < 0.5 deg) are expected to be very different from those observed toward the optical microlensing field (b~3deg). The typical event time scale of bulge-lens and bulge-source events would be ~ 2 days, whereas those toward the less extincted field have typical event time scale of ~ 20 days. The planetary signal would last a few hours toward the inner Galactic center. To observe such short microlensing events and the planetary signals toward the highly extincted region, K-band, wide FOV, and high-resolution are required, and ULTIMATE-Subaru is the best facility for this purpose. Such survey will, for the first time, allow us to study the planet frequency in the dense stellar environment. We will present a microlensing survey planned with ULTIMATE-Subaru. Also, we will mention possible synergies with other surveys toward the Galactic center: PRIME, WFIRST and JASMINE.
(Day4) Subaru Telescope of the Future: ULTIMATE
11/20/2019, 17:15 - 17:20

Yusei Koyama
(Subaru Telescope)

Title: ULTIMATE session summary/promotion

Abstract: N/A