Synergy with TMT
11/18/2019, 9:00 - 9:15

Tomonori Usuda
(NAOJ)

Title: Thirty Meter Telescope (TMT)

Abstract: Based on the scientific and engineering success of Subaru Telescope, astronomers are preparing to begin construction of the Thirty Meter Telescope (TMT) at Maunakea, Hawai`i as an international science project. The TMT is an extremely large 30-meter optical/infrared telescope under the collaboration of five partner countries including Japan, USA, Canada, China, and India. In 2014, an agreement was executed between the participating organizations, TMT International Observatory was founded to assume the construction and operation of the observatory, and construction commenced.

With an aperture of 30m, TMT will have more than 10 times as much light-gathering power as the Subaru Telescope, and more than 10 times the resolution of the Hubble telescope to deepen the human perception of the structure and evolution of the Universe, and the origins of stars, planets and life.

Although the Hawai`i onsite construction is delayed, mass production of the telescope primary mirror, design works of the telescope subsystems including science instruments have proceeded according to plan in the partner countries. I present the progress of the TMT project, status of the Hawai`i construction site, and Japan’s progress on its work share.
Abstract: The era of the Extremely Large Telescopes (ELTs) is fast approaching and will revolutionize exoplanet science in a way even beyond what will be possible from space. The combination of the enormous collecting area and the exquisite angular resolution of ELTs will enable the detection and characterization of exoplanets from gas giants and sub-Neptunes and even into the realm of Earths and Super-Earths. Precise radial velocity measurements will attempt to detect Earths in the Habitable Zones of solar-type stars while transit spectroscopy will probe the atmospheres of a broad range of planets masses orbiting a wide variety of host stars. Direct imaging and spectroscopy will, for the first time, enter the inner reaches of planetary systems where exoplanets are much more plentiful than they are at larger orbital distances. For M stars it is plausible to consider direct imaging down to the level of Habitable Zone Earths. Diffraction-limited, single-mode-fiber fed instrumentation enabled by Adaptive Optics will make it possible to build instruments combining high spatial resolution (10 mas) and high spectral (R~150,000) resolution instruments at modest cost. These new instruments will be able to characterize elemental and molecular abundances, atmospheric structure and even weather patterns on these other worlds.
Synergy with TMT
11/18/2019, 9:40 - 10:05

Mark Dickinson
(NOAO)

Title: Studying galaxy evolution with TMT and Subaru in the global era of Extremely Large Telescopes

Abstract: After two decades of observations with 8-10 meter class telescopes, some of today’s forefront astronomical problems demand new facilities with still larger apertures. The forthcoming generation of Extremely Large Telescopes (ELTs) will offer tremendous gains in angular resolution and sensitivity, opening new frontiers in nearly all areas of astrophysics, from our Solar System to cosmology.

There will be important scientific synergies between the ELTs and the 8-10m telescopes. I will examine some cases for studies of galaxy formation and evolution, with special emphasis on Subaru and the Thirty Meter Telescope (TMT). I will also discuss TMT’s part in the US ELT Program (US-ELTP), a partnership between NOAO, TMT and the Giant Magellan Telescope to provide US national access to a 2-telescope, 2-hemisphere ELT system. The US ELT Program can also provide unique opportunities for international collaboration spanning the global partnerships of TMT and GMT.
Synergy with TMT
11/18/2019, 10:05 - 10:30

Masashi Chiba
(Tohoku University)

Title: Exploring the Local Universe with TMT

Abstract: TMT will provide important opportunities for revolutionary discoveries in the studies of the Local Universe including all galaxies in the Local Group and beyond. Here we preset several key science cases to be addressed and performed with TMT, especially in synergy with past and future Subaru contributions in this field of research.
Future Wide-Field Surveys
11/18/2019, 10:35 - 10:50

Satoshi Miyazaki
(NAOJ)

Title: Introduction for this session

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Title: The LSST Dark Energy Science Collaboration

Abstract: The Large Synoptic Survey Telescope (LSST) will revolutionize a wide range of fields across astronomy. It will be particularly powerful for the next generation of investigations of cosmology and dark energy. The LSST Dark Energy Science Collaboration (DESC) is a large international collaboration that is preparing to make high-accuracy measurements of fundamental cosmological parameters using data from LSST. By using measurements from weak lensing, galaxy clustering, clusters, supernovae, and strong lensing, DESC will determine the tightest constraints on dark energy to date from this flagship facility of the next decade.

In this talk I will summarize the LSST capabilities, mission, and partnership model. I will then discuss the key DESC cosmological probes, the challenges expected for each probe, and the predicted combined cosmological constraints.
Title: The Euclid Survey

Abstract: The ESA Euclid spacecraft will be launched in June 2022 and, over the following 6 years, will cover 15,000 square degrees of extragalactic sky. Euclid will measure the geometry and growth of structure in the dark Universe through gravitational lensing and galaxy clustering. The two on-board scientific instruments, designed for galaxy shape and redshift measurements at visible and near-infrared wavelengths, will yield a truly unique and revolutionary legacy dataset that will enable countless scientific studies in fields ranging from cosmology to the Galaxy. The mission relies on ground-based observations to provide deep multi-band (ugriz) photometry to deliver the photometric redshifts for gravitational lensing tomography. This talk first summarizes the current status of the ESA mission (spacecraft, instruments, operations and dataset production by the Euclid Consortium). The second part of the talk focuses on plans for the space survey, which also includes a 40 square degree deep survey composed of three areas spread across the sky, as well as the critical complementary ground-based observations needed for the mission to achieve its goals.
Future Wide-Field Surveys

Mike Hudson
(Waterloo Centre for Astrophysics)

Title: Euclid Science and Synergies

Abstract: The Euclid mission aims at understanding why the expansion of the Universe is accelerating and what is the nature of the source responsible for this acceleration. The imprints of dark energy and gravity will be tracked by Euclid using two complementary cosmological probes to capture signatures of the expansion rate of the Universe and the growth of cosmic structures: weak gravitational lensing; and galaxy clustering (both through baryonic acoustic oscillations and redshift-space distortions). Although low-redshift cosmology is the primary driver of the mission, a wide range of science will be possible with the Euclid data. The Euclid Mission aims to survey over 15,000 square degrees of the extragalactic sky with imaging in a wide visible (riz) band at 0.1” resolution, near-infrared photometry (Y, J, and H) and near-infrared spectroscopy. As a result, the Euclid Mission will generate a vast data set for legacy science, including broadband visible images and near-infrared photometry of roughly 1.5 billion galaxies and near-infrared spectroscopy of roughly 25 million galaxies. Such a large data set will touch on many aspects of astrophysics, on many different scales, from the formation and evolution of galaxies down to the detection of brown dwarfs. In additions, “Euclid Deep Fields” covering around 40 square degrees in total will be also observed, extending the scientific scope of the mission to the high-redshift Universe. This talk will describe the surveys and the key science cases, and it aims to stimulate ideas for complementary and followup observations with Subaru and other telescopes.
Title: **WFIRST: Project Overview and Status**

Abstract: The Wide-Field InfraRed Survey Telescope (WFIRST) will be the next NASA Astrophysics strategic mission to follow JWST. The observatory payload consists of a Hubble-size telescope aperture with a wide-field NIR instrument and a coronagraph operating at visible wavelengths that employs state-of-the-art wavefront sensing and control. The Wide-field instrument is optimized for large area NIR imaging and spectroscopic surveys, with performance requirements driven by programs to study cosmology and exoplanet detection via gravitational microlensing. All data will be public immediately, and substantial general observer and archival research programs will be supported.

The WFIRST Project is presently in Phase B, with the confirmation review expected in early 2020. We will present an overview of the present mission design and expected performance, a summary of Project status, and a description of representative observing programs.
Title: WFIRST's General Observer and Coronagraph Instrument (CGI) Programs

Abstract: WFIRST will carry out a robust General Observer (GO) program in which anyone can propose WFIRST observations and peer review will pick the most compelling science. The GO program will use 25% of the time in WFIRST's primary mission and ~100% of the time in a possible extended mission. The WFIRST Coronagraph Instrument (CGI) will carry out technology demonstration observations over the course of 3 months of observing time in the first 1q8 months of WFIRST operations. If the performance of the CGI warrants it, further science observations might be made with CGI after the technology demonstration.
Title: Subaru-WFIRST Synergistic Observation white paper

Abstract: Subaru-WFIRST Synergistic Observations have the potential to enhance science that cannot be done by either telescope alone. The unprecedentedly deep and wide field NIR imaging capability of WFIRST is complementary to the wide field unique instruments of Subaru for both imaging and spectroscopy. JAXA and NASA are discussing about the potential contribution of Japan for the WFIRST project. One significant aspect discussed so far is to conducting the Subaru-WFIRST Synergistic Observations to benefit both WFIRST project and the Subaru science community. Representatives from the WFIRST Formulation Science Working Group (FSWG), the WFIRST Project, the Japanese Subaru community, and the Japanese WFIRST working group organized the second Subaru-WFIRST Workshop in December 2018 to discuss the most compelling joint observations which significantly enhance the WFIRST Core Survey science cases or enable new science programs based on the unique combination of Subaru and WFIRST. We overview the white paper which summarized these discussions and show some details of bulge and microlensing sciences.
WFIRST-Subaru Synergy
11/18/2019, 15:50 - 16:15

Masahiro Takada
(Kavli IPMU)

Title: **Synergetic cosmology program with Subaru and WFIRST**

Abstract: Here I would like to discuss what kinds of opportunities in cosmology are available by combining datasets from the WFIRST and Subaru Telescope.
Title: **Subaru-WFIRST Deep Fields and Galaxy Evolution Studies**

Abstract: I introduce our discussion about the deep field observations jointly conducted with Subaru and WFIRST, and present strawman plans for galaxy evolution studies.
WFIRST-Subaru Synergy
11/18/2019, 16:40 - 17:05

James Rhoads
(NASA GSFC)

Title: Combining WFIRST and Subaru Observations to Study Cosmic Dawn

Abstract: WFIRST and Subaru will offer an unprecedented combination of capabilities for understanding Cosmic Dawn and cosmological reionization. Our WFIRST science investigation team has been examining strategies to measure ionizing photon production through WFIRST imaging surveys, and to probe Lyman alpha transmission through the intergalactic medium using deep WFIRST slitless spectroscopy. Subaru PFS spectroscopy offers resolving power, sensitivity, and multiplexing that will enable measurement of Lyman alpha line profiles for numerous, modest sized galaxies, as well as measuring near-zone sizes for epoch-of-reionization quasars in WFIRST surveys. HSC imaging can provide optical SED constraints, including medium and narrow-band capabilities not otherwise available. We are also exploring synergies with upcoming redshifted 21cm experiments. Together, these capabilities will allow studies of reionization that would not be possible with either WFIRST or Subaru alone.