【Grant-in-Aid for Scientific Research (S)】

Science and Engineering (Mathematical and Physical Sciences)

Title of Project : Imaging Habitable Zone Planets with Subaru Telescope and TMT

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Research Project Number : 26220704 Researcher Number : 90399288
Research Area : Astronomy
Keyword : Exoplanet, High contrast instrument

【Purpose and Background of the Research】

The number of known exoplanets is growing at an accelerating pace, allowing statistically results to be derived. While the most successful exoplanet discovery are currently using indirect techniques (radial velocity or transit technique), detailed characterization of the planet's surface or atmosphere will require direct imaging. Direct imaging is therefore a strategic long-term goal for the study of exoplanets, especially for finding evidence of life outside our solar system. The purpose of our activity is to develop a powerful system for imaging exoplanets, and for the first time allow detection of light reflected by giant exoplanets.

【Research Methods】

Combining two revolutionary technologies that have emerged in the last decade, we will (1) improve the existing Subaru Coronagraphic Extreme Adaptive Optics (SCExAO) instrument so that it will image and characterize giant exoplanets

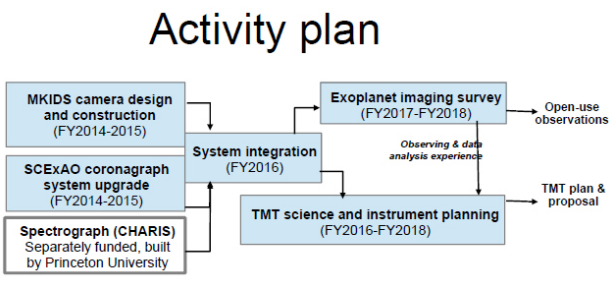

Figure1 Activity plan

in habitable zones with the 8.2m Subaru telescope (2) prepare the improved instrument so that it will be able to image and characterize habitable planets with the Thirty Meter Telescope (TMT) in year ~2022. The main part of our upgrade is a high-speed sensitivity wavelength resolving camera (MKIDS) which will be built in FY2014/FY2015 at UC Santa Barbara. In parallel to this effort, the existing SCExAO system coronagraph and speckle control loop will be improved in contrast and speed. Activities to prepare habitable planets imaging with TMT will proceed in parallel.

【Expected Research Achievements and Scientific Significance】

Our proposed activity will greatly improve the performance of the existing SCExAO system, allowing for the first time detection of light reflected by giant exoplanets. At the outcome of our effort, we will have established the most powerful exoplanet imager in the world at small angular separations on Subaru Telescope, and we will make it widely available to observers. The instrument system we will design will have been developed by a team of experts with a strong drive towards enabling direct imaging and characterizing habitable planets around nearby M-type stars. We will also have established an exciting TMT science opportunity. Our effort will ensure that both the instrument plan is ready to start habitable planet observations on TMT within 2 years of its first light with adaptive optics.

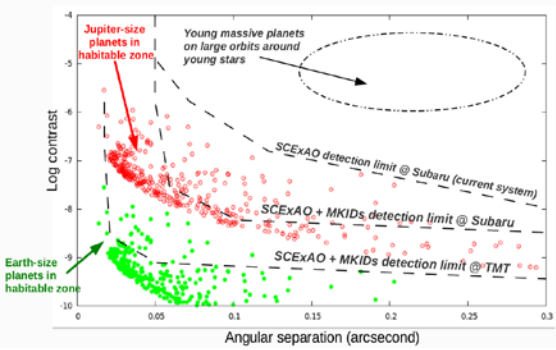

Figure2 our targets vs expected contrast and angular separation

【Publications Relevant to the Project】

Guyon, O., et al. 2014, ApJ, 780, 2, 171
Martinache, F., et al. 2012, PASP, 124, 922,1288
Mazin, B.A., et al . 2013, PASP, 123, 933

【Term of Project】 FY2014-2018

【Budget Allocation】 117,200 Thousand Yen

【Homepage Address and Other Contact Information】

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