



Title of Project : New Frontiers of Extrasolar Planets: Exploring Terrestrial Planets

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【Purpose of the Research Project】

Since the discovery of extrasolar planets (or exoplanets) in 1995 orbiting around stars other than the sun, they have been drastically changing our vision of the universe. With more than 500 discovered so far, exoplanets exhibit an astonishing diversity we have never imagined before when we knew only eight planets of our own solar system. Some exoplanets are rocky like the earth. Some may hold liquid water (like oceans) on their surfaces and be capable of sustaining life.

For decades, we have been leading planetary formation theories in the world with renditions such as the Kyoto model of our solar system formation. Radio observations of protoplanetary disks began as early as their presence was recognized. Subaru telescope discovered disks with peculiar morphology and successfully imaged an exoplanet recently.

The purpose of this project is to expand these research activities in Japan. With new instruments to be developed, we would like to make a survey for rocky planets possibly holding liquid water. We will take direct images of exoplanets, get their spectra, and analyze their atmospheric characteristics. We also observe the formation process of planets using the newly completed radio interferometer called ALMA. We will also develop theories of planet formation and planetary atmosphere. Comparison of the observations with theories will allow us to comprehensively understand the origin, formation and evolution of planets. Raising young generations of researchers and students to lead this exciting field in the future is also one of the purposes of this project.

【Content of the Research Project】

This research project consists of the following four subprojects.

A01: Direct Imaging and Spectroscopy of Gas Giants and Detection of Earth-like Planets — including indirect detection of earth-like planets, and direct detection and spectroscopy of gas giants.

A02: Numerical Modeling of Exoplanetary Atmosphere and Characterization — to develop comprehensive models of planetary atmosphere and interpret spectroscopic data of exoplanets.

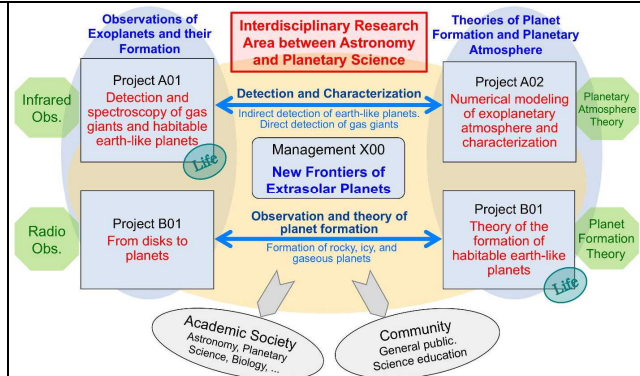


Fig. 1 — Overview of the project

B01: From Disks to Planets — to carry out observations of protoplanetary disks with ALMA and Subaru.

B02: Theory of the Formation of Habitable Earth-like Planets — to develop comprehensive models of the formation of planets including those that can sustain life.

【Expected Research Achievements and Scientific Significance】

Implication of exoplanet research is profound in the sense that human beings, after thousands of years of wondering, have attained the possibility of finding the first real answers to one of the most meaningful questions such as “how we and our world came to be?” It will surely be one of the most important research fields in the 21st century. We hope that, with our project, we will consolidate the foundations of exoplanetary research in Japan so that we will continuously make significant contributions to this field. We would thus like to raise younger generations in addition to achieve expected results such as the detection of habitable rocky planets, etc.

【Key Words】

Exoplanets: Planets orbiting around stars other than the sun.

Protoplanetary disks: Disks around young stars and the site of planet formation.

【Term of Project】 FY2011-2015

【Budget Allocation】 946,800 Thousand Yen

【Homepage Address and Other Contact

Information】

<http://exoplanets.astron.s.u-tokyo.ac.jp/>