【Grant-in-Aid for Specially Promoted Research】
Science and Engineering (Mathematics/Physics)

Title of Project : Development of Exoplanet Researches with New IR Technologies

Motohide Tamura
(National Astronomical Observatory/NINS, Optical and Infrared Division, Associate Professor)

Research Area : Astronomy

Keyword : IR Astronomy, Exoplanet, Adaptive Optics, Infrared Detector, Wavelength Calibration

【Purpose and Background of the Research】

Since the first detection of exoplanets orbiting normal stars in 1995, more than 450 exoplanet candidates have been discovered mainly by indirect methods and many exciting discoveries have been made, but our understanding of planetary systems and their formation is far from complete. A census of companions to stars over a wide range of ages will provide important clues to the formation and evolution of stars, brown dwarfs, and planets. On the other hand, although the standard theory of planetary formation predicts existence of a number of Earth-like planets, they are basically yet uncovered. Therefore, in the rapidly growing exoplanet studies, the next two critical milestones are direct imaging and Earth-like planet detection.

【Research Methods】

In this research we will conduct a first large scale "direct imaging survey" with our newly developed high-contrast instrument for exoplanet systems similar to our solar system. The survey will explore the regions where the previous indirect methods such as the radial velocity or transit ones have been unable to observe (Figure 1).

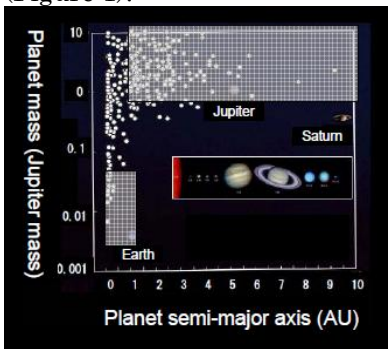

Figure 1 Planets inside and outside our Solar System as well as the parameter spaces to be explored in this research.

We will develop a high precision near-infrared radial velocity instrument with employing various new IR technologies such as frequency-comb, IR arrays, gratings, and IR wavefront sensing.

【Expected Research Achievements and Scientific Significance】

We aim to detect many giant planets at a few to a few tens astronomical units (Figure 2) and derive their properties (luminosity, temperature, composition). With a comparison of the disk observations at the same regions, we can reveal the origin of the diversity of exoplanets and discuss if our Solar System is unique or not.

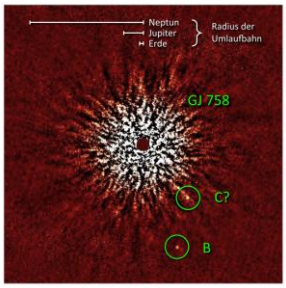

Figure 2 Direct imaging of an exoplanet.

We also aim for detecting down to one Earth-mass planet in habitable zones around low-mass stars by the IR radial velocity method (Figure 1). This will enable us to discuss the statistics of Earth-like planets and even the life in other worlds.

【Publications Relevant to the Project】

Watanabe, J. et al. eds, Nippon-Hyoron-sha, Modern Astronomy Vol.9, 2008.
Ida, S., Sato, B., Tamura, M., Suto, Y, Gijyutsu Hyoron-sha, Many Other Earths, 2008.

【Term of Project】 FY2010-2014

【Budget Allocation】 396, 900 Thousand Yen

【 Homepage Address and Other Contact Information】

http://optik2.mtk.nao.ac.jp/~hide/index.html
motohide.tamura@nao.ac.jp