

Search for Habitable Planets Around Low-Mass Stars Using the InfraRed Doppler Instrument

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Detecting low-mass planets in the habitable zone around low-mass stars is one of the milestones to understand the habitable planets outside the solar system. Several new planet search programs will thus start in the near future to search for low-mass planets around low-mass stars (e.g. CARMENES, SPIRou, TESS).

Now, we are also planning a Doppler (radial velocity, RV) exoplanet survey of low-mass stars by using a new near-infrared instrument, the InfraRed Doppler instrument (IRD) to be installed to the Subaru 8.2m telescope in 2014. Aims of the survey are to find Earth-mass planets in the habitable zone and uncover the statistical properties of the planetary systems around low-mass stars. Observation targets of the RV survey are about 300 M dwarf stars that have masses with 0.1-0.6 times solar masses and a flux peak in the near-infrared wavelength region. IRD is an exoplanet hunting instrument with a laser frequency comb and a near infrared high-resolution spectrograph, and suitable for the search for low-mass planets around M dwarfs. The RV measurements of M dwarfs with IRD would achieve the high precision of about 1 m/s by producing extremely stable references for accurate wavelength calibration by using the laser frequency comb. Therefore, we expect to detect a few Earth-mass planets in habitable zone and some rocky planets in close-in orbits around low-mass stars (Figure1). In the IRD project, we also have plans to perform the photometric (Transit) and spectroscopic (RV) follow-up observations of planet candidates detected by IRD using Japanese facilities.

In this presentation, we introduce the IRD and the Doppler exoplanet surveys of low-mass stars, and discuss observational strategies and the expected results of the IRD project.

Figure 1: Detectability of planets (Contour, simulation) for the IRD survey and results of population synthesis (Dots, Y. Hori et al. 2013). In an observation strategy, we would expect to detect some Earth-mass rocky planets around very low-mass stars by the IRD survey.

