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論 文 要 旨
THESIS SUMMARY

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要旨（英文800語程度）
Thesis Summary (approx.800 English Words)

The origin of "radius gap" in close-in planets around lower-mass stars are not understood well. The paucity of planets between the radii 1.5 - 2 $R_\oplus$ in the radius-period diagram is termed as radius gap (Fulton et al. 2017). The primary candidate for explaining the origin of radius gap is the evaporation theory (Owen & Wu 2013, 2017), which predicts that the smaller planets are born with a core of 1 $R_\oplus$, surrounded by a 1% (by mass) voluminous envelope of H/He. In the first few hundred million years after forming, the high-energy radiation from the star induces the evaporation of this hydrogen and helium dominant atmosphere, thereby reducing the radius of the planet. That is the planet shifts from larger radius (higher peak around 2 $R_\oplus$ of the bimodal distribution; Fulton et al. 2017) to a lower radius (around 1 $R_\oplus$) due to photoevaporation. This prediction has been studied for smaller planets around solar-type stars (Fulton et al. 2017), however not for cooler K- and M-type stars. In this study, we present our observations of planets in and around the radius gap orbiting cooler K- and M-dwarfs. We find the lack of evaporative atmospheres in all our K- and M-dwarf targets (AU Mic b, GJ 9827b, GJ 9827d, TRAPPIST-1b, TRAPPIST-1e, TRAPPIST-1f and TOI-1235b) indicate that the evolution of smaller close-in planets around low-mass stars are different from those around solar-type stars. We attempt to understand the validity of various other models (like core-powered mass-loss; formation in a gas-poor environment) in the contect of our observations. We also present the detection of an evaporative atmosphere in a very young 17 Myr hot Jupiter, HIP 67522b around a G-Dwarf.

In this study, we also focus on the detectability of NIR molecular O_2 features from the lower atmospheres of TRAPPIST-1b, e and f planets. We do not detect any molecular O_2 features from TRAPPIST-1b and TRAPPIST-1e from our cross-correlation analysis of the observation from Subaru/IRD. However, in TRAPPIST-1f, we see a small feature of SNR 2 at -4 km/s in planet rest frame, but we cannot confirm the origin of this feature without further observations. We also estimate the detectability of this feature from a future 30m class telescope with a spectrograph of resolution 100,000. We simulate the observations for a variety of atmospheres with different pressure levels. The simulations indicate that the desiccated O_2 atmospheres can be determined within 10 transits for TRAPPIST-1b, e and f. However, the Earth-like atmospheres can be detected only with 50-200 transits. Also our simulations provide the basic necessary information on planning the observations in a future 30m class telescopes.

備考 ： 論文要旨は、和文2000字と英文300語を1部ずつ提出するか、もしくは英文800語を1部提出してください。
Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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