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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)

More than 900 exoplanets have been discovered so far, and their diversity in orbital parameters, masses, and host star's properties is now providing us many valuable insights into histories of formation and evolution of planets. Statistical studies for the host stars as well as the planets are fundamental and necessary approaches to solve complicated correlations between their properties. A correlation between stellar metallicity and a planet property is one of the important and well-studied subjects. Especially, distribution of the planets along orbital period is a vital information in understanding environment of planet birthplace and subsequent evolution of planetary orbits such as migration and scattering. However, it is still unclear how the planet properties such as the physical parameters and the frequency distribution correlate with stellar metallicity, while previous studies reported that the planet frequency itself exponentially arises as stellar metallicity increases.

In order to clarify the correlation between stellar metallicity and the planet properties, we have conducted a radial-velocity search for exoplanets around metal-rich 635 FGK dwarfs since 2009. The 8.2m Subaru telescope and the 188 cm telescope at Okayama Astrophysical Observatory have been mainly used for this study.

Our approaches are as follows; (1) increasing the number of detected planets around metal-rich stars in a wide range of orbital periods, and (2) performing statistical analysis of planet distribution based on our detections. We also correct for "missed planets" in the analysis by taking detection limits and completeness of our survey into account.

By optimizing our radial-velocity analysis method to long-term observations, we have succeeded in detecting 6 new planets around 4 metal-rich stars, HD 1605, HD 1666, HD 38801, and HD 67087 with the stellar masses higher than $1.3M_{\odot}$. Each of HD 1605 and HD 67087 has a double-planet system, so-called a hierarchal system. All of the detected planets have nearly circular orbits ($e < 0.1$) except for that around HD 1666. Their orbital periods are typically hundreds of days, and those of the outer planets in double-planet systems are longer than 2000 days, corresponding to the semi-major axis larger than 3 AU. Such multi-circular orbit planetary systems of HD 1605 and HD 67087 have rarely been discovered so far, and should be important samples as results of orbital evolutions without planet-planet interactions after a disk-gas-dissipation. HD 1605 is also suggested to have a distant companion based on its long-term trend in radial velocity, indicating the hints to the formation history of multiple jovian-planet systems. HD 38801 is a single-planet system with super massive ($> 10M_{JUP}$) companions with a circular orbit. Such a system is rare for main-sequence stars and subgiants and important sample as one of the largest mass planets via core accretion formation. HD 1666 is a very metal-rich star with its large mass of $1.5M_{\odot}$ hosting an eccentric and massive single-planet. The star is one of the largest mass main-sequence planet hosts.

Including the four planet hosts from our detections, we selected 199 well-observed stars from our targets and performed statistical analysis for them. We found that the planet frequency has an increasing trend toward longer orbital periods in logarithmic scale, and the power-law function fitted to the trend is steeper than the case of solar-type stars with confidence level higher than 1σ. Our result may suggest that efficiency of orbital migration via interaction between disk gas and protoplanets around stars may correlates to stellar metallicities and/or stellar masses. Taking into account the previous observational studies for disk lifetimes and distribution of planets around stars with masses of above $1.5M_{\odot}$, it can be thought that stellar mass is relatively preferable to explain the difference of the planet distribution along orbital periods. More data and planetary samples with various stellar masses are required for further improvement for statistical analyses.

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).