論文 / 著書情報
Article / Book Information

題目(和文)	
Title(English)	Radial-velocity search and statistical studies for short-period planets in the Pleiades open cluster
著者(和文)	宝田拓也
Author(English)	Takuya Takarada
出典(和文)	学位:博士(理学), 学位授与機関:東京工業大学, 報告番号:甲第11057号, 授与年月日:2019年3月26日, 学位の種別:課程博士, 審査員:佐藤 文衛,中本 泰史,井田 茂,野村 英子,玄田 英典
Citation(English)	Degree:Doctor (Science), Conferring organization: Tokyo Institute of Technology, Report number:甲第11057号, Conferred date:2019/3/26, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

系・コース： Department of, Graduate major in	地球惑星科学 地球惑星科学	系 コース	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of	（ 理学 ）
学生氏名： Student's Name	宝田拓也		指導教員（主）： Academic Supervisor(main)	佐藤文衛	
			指導教員（副）： Academic Supervisor(sub)		

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

The first exoplanet discovered in 1995 was 51 Peg b and we know the exoplanet as a Hot Jupiter (HJ). Since then, hundreds of HJs have been discovered. The discovery of HJs have advanced the theory of planetary formation and evolution as well as the comprehension of statistical properties of exoplanets. The formation and orbital evolution of HJs, however, remain unclear.

To explain the formation of HJs, there are two contending hypotheses of mechanisms - gas disk migration (GDM) and high eccentricity migration (HEM). Although both GDM and HEM can reproduce the observed HJs to a certain extent, the timescale over which the HJs are formed is quite different. While with GDM it takes less than 10 million years (Myr) for an HJ to form, with HEM it takes several hundreds of Myr. In spite of the vastly different timescales, it is still unclear which of the mechanisms is responsible for the formation of HJs. This is mainly because most of the HJs discovered revolve around old stars (several Gyr) and thus, sufficient information on planets orbiting around younger age stars is not available.

Transit observations have discovered more number of massive HJs (MHJs) orbiting F-type dwarfs than those orbiting G-type dwarfs. According to several theoretical studies, MHJs around G-type dwarfs can be considered to have been engulfed by a central star over several Gyr due to tidal interactions. However, the paucity of MHJs orbiting G-type stars is stronger than that theoretically predicted, which indicates the possibility that either MHJs are originally less likely to form or get engulfed by the central star due to strong tidal interactions. Planet discovery around young stars can help to reveal whether this paucity of MHJs is caused by the orbital evolution of planetary systems and subsequent engulfment or low probability of MHJ formation.

To investigate the formation and orbital evolution of HJs, we conducted a radial velocity (RV) survey of young stars in the Pleiades open cluster (~0.1 Gyr). In November and December 2017, we observed thirty Pleiades member stars at the Okayama Astrophysical Observatory (OAO) with High Dispersion Echelle Spectrograph (HIDES). We computed four activity indicators (FWHM, Vspan, Wspan and $S_{H\alpha}$) as well as the RVs, which further enabled us to evaluate and mitigate the RV variations caused by the host stars' surface modulation. We found that the RVs of several stars were influenced by stellar activities. In particular, several stars showed significant RV variations. Based on the analysis of stellar activities, we found that these RV variations were caused by stellar activities, and concluded that no planet candidates were detected from our observations. For the stars exhibiting RV variations caused by stellar activities, corrections to reduce the stellar intrinsic RV variations were performed. We also derived the relations between RMS of RVs and activity indicators, and found that FWHM, Vspan and Wspan were useful indicators to estimate the stellar activities.

We performed a statistical analysis on our sample. For this, firstly, we determined the detection limits for each of the samples and derived the search completeness of our survey. Based on the search completeness, we ruled out the probability of existence of massive HJs with orbital periods between 1-5 days. Next, we determined the planet occurrence rate from our survey and set the upper limit for the planets with masses 1-13 M_{JUP} and period 1-10 days.

To set a more stringent constraint on the planet occurrence rate, we combined the result of our survey with those of other surveys targeting open clusters with ages between 30-300 Myr. To take into account the different detection sensitivities, we divided the sample planet mass range into three: 1-5, 5-13, and 13-80 M_{JUP}. As for the mass range of 1-5 M_{JUP}, our result was consistent with the occurrence rate for field stars and M 67 open cluster. As for the mass ranges of 5-13 and 13-80 M_{JUP}, we were able to set a strong constraint on the planet occurrence rate.

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).

注意：論文要旨は、東工大リサーチリポジトリ(T2R2)にてインターネット公表されますので、公表可能な範囲の内容で作成してください。
Attention: Thesis Summary will be published on Tokyo Tech Research Repository Website (T2R2).