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論 文 要 旨

THESIS SUMMARY

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学生氏名： Student's Name	李 尚姬	指導教員（主）： Academic Supervisor(main)	佐藤 文衛
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

Sun-like stars are important targets for exploring exoplanet and various features of stars like the Sun. In Sun-like stars, the atmosphere exhibits various phenomena, generally induced by the magnetic fields and the active regions in the stellar convective outer atmosphere. The stellar magnetic activity is observed on the outer atmosphere, the chromosphere. The chromospheric emission is observed in various spectral lines, especially the Ca II H&K line cores (3933, 3968 Å) are most well-studied in the diagnosis of the stellar magnetic activity.

The Ca II H&K line monitoring on a long time-scale has revealed stellar magnetic activity cycles for the Sun-like stars. The magnetic activity cycle is important to understand the stellar magnetic activity behaviors. The magnetic activity of stars having a convective zone is related to the stellar dynamo and therefore the study of the magnetic activity cycle leads us to understand the stellar magnetic field and the dynamo. It has been reported that most G- and K-type stars show long (from 2.5 yr to more than 20 yr) and pronounced activity cycles, and that some G- and K-type stars might have two activity cycles simultaneously by the previous Ca II H&K observations. However, the solar and the stellar dynamo are still poorly understood despite the continuous study of the solar cycle discovered many decades ago.

Meanwhile, for F-type stars, although there have not been so many cases to suggest their activity cycle, recent research suggested that they have a relatively short activity cycle within 1-2 years. This short activity cycle could provide an ideal time-frame to study the stellar dynamo. It is important to increase observations of F-type stars.

The monitoring of the Ca II H&K line focusing on the planetary perspective has also been performed. The existence of a hot-Jupiter can influence the stellar magnetic activity, and the effect could be represented by enhancements of the activity variability (Star-Planet Magnetic Interaction, SPMI). In addition, the stellar activity variability can affect the detectability of exoplanets. Investigating the magnetic activity variability is therefore important for exoplanet researches as well.

The Hα line (6563 Å) can also be an accessible indicator like the Ca II H&K line. However, as observations in the Hα line have not been performed enough, the dependence on stellar parameters has not been established observationally for the Hα line. Clarifying the activity variability in the Hα line is helpful for future observational studies of the stellar magnetic activity and exoplanet searches.

We report the results of intensive monitoring of the activity variability in the Hα line for several F-, G- and K-type stars over the last four years 2019-2022, in order to investigate their latest magnetic activity from various aspects, including activity cycles, amplitudes of variability, and search for exoplanets. The 4-year Hα line intensity data taken with 1.88-m reflector at Okayama Branch Office, Subaru Telescope, shows their intrinsic magnetic activity variability for each target star. We found the correlation between the variability in the Hα line and the activity level derived from the Ca II H&K line. Thus, we conclude that HIDES Hα observation is sufficient to present the magnetic activity variability of the target stars, and the Hα line can be used as an activity indicator. In addition, we present the possible dependence of the Hα variability on other stellar parameters, like stellar age or Rossby number. Our Hα variability could help to estimate the amplitude range of activity variability that affects future exoplanets or activity cycle searches for other stars.

We found the existence of the possible short-term activity cycle in three of the four F-type target stars, including τ Boo, whose Hα result is consistent with the previous results of Ca II H&K line. It is suggested that the Hα results could support the short-term activity cycle trend in F-type star.

For some G- and K-type target stars which are expected to show a shorter cycle of co-existing cycles, we confirmed the shorter cycle of a K-type star, ε Eri in the Hα line. Although we could not detect the expected shorter cycle of two G-type stars, β Com and κ^1 Cet, we estimate the non-detection limit of a shorter activity cycle from the amplitude of the Hα variability. For the other G- and K-type target stars, as we could not find any periodic variations, we also set the non-detection limit. Our Hα results provide supportive information to further investigate a short-term period component of these stars for subsequent observations.

In respect of the SPMI detection, we could not detect signature of the SPMI for some target stars with a hot-Jupiter. We set an upper limit of non-detection of the SPMI. It suggests that the magnetic activity variability detected in this Hα observation is related to the stellar intrinsic activity rather than the existence of exoplanets.

We suggest that the impact of the activity variability in the Hα line on the RV measurement would be different by spectral type. Also, it is speculated that there is no significant correlation between the activity variability detected in this observation and the previous RV measurements. We suggest that the magnetic activity variability with the detected amplitude in the Hα observation might not affect exoplanet searches for most individual target stars with the precision of few m/s. There is still the possibility that the magnetic activity variability may induce a RV variation for few stars, and we assume the amplitude range of the Hα variability that could affect the RV for the individual stars.