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Star Spot Activities of Solar-type Stars with Hot-Jupiters in Kepler Data

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The long-term observations of the Kepler space telescope provided high precision time-series photometric measurements of more than 160,000 stars in a 115-square-degree field near Cygnus and Lyra. More than 2,000 exoplanet candidates orbiting around Solar-type stars have been found. Among them 15 are hot-Jupiters, which might have strong star-planet interaction. In this study, we analysed the short cadence (1 minute) lightcurve data of Kepler-17, Kepler-41, and Kepler-43 that are G-type main-sequence stars each with a hot-Jupiter. The masses of the host stars are 1.16 M_{sun}, 0.94M_{sun}, and 1.19 M_{sun}, respectively. The masses of the hot-Jupiters around them are 2.45 M_J (Jovian mass), 0.49M_J, and 3.23 M_J, and the orbital periods are 1.48 d, 1.85 d and 3.02 d, respectively. The orbital planes of these hot-Jupiters are all within 10 degrees of the line-of-sight. (Santerne et al. 2011 and Bonomo et al. 2012) Kepler-17 showed strong magnetic activity of which the star spot coverage could be as much as 5% of the hemispherical area. The other two have smaller spot sizes ($\sim$ 0.5% of stellar hemispherical area). We have examined their lightcurves to check whether they exhibit flare activities over the time interval of the Kepler measurements (2009$\sim$2013). That none was found is consistent with the report by Shibata et al. (2012). We examined the variations in the hot-Jupiter transiting lightcurves to measure the spot size and location in detail. The statistical data can be used to infer the migration process of the star spots across the stellar disk. The large size of its spots means that Kepler-17 should have frequent occurrence of superflares. The absence of superflare activity is therefore puzzling. The possible energy dissipation effect of coronal magnetic field interaction with the hot-Jupiter (Kepler-17b) is discussed in the study.

[References]

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