CHAPTER 5

CONCLUSION

Exoplanets are planets located outside of the solar system which have been discovered since 1992 (Wolszczan and Frail, 1992). At present, there are more than 1900 exoplanets have been discovered by several methods, including transit method. The transit method is method which looks for a periodic dip in the stellar light curve when the orbit of one of the planet passes in front of the star. Transit technique detects more than 1,200 planets with various radii: Earth size to larger than Jupiter size. from transit observations, orbital parameter of planetary system, and physical parameters of planet are obtained.

In this research, we study exoplanet GJ3470b by transit method. It is a transiting hot Uranus, sub-Jovian exoplanet orbiting a nearby M-dwarf (Bonfils et al., 2012). Photometric observation of exoplanet GJ3470b were obtained through Counsins-R filter with CCD camera attached to 0.5-m telescope at Thai National observatory (TNO) and 0.6-m telescope at Cerro Tololo Inter-American Observatory (CTIO) during 2013-2015. The photometric observations data were reduced by using MaxIm DL3 program. Four transit light curves were obtained and analyzed using TAP program. We obtained the orbital and physical parameters of exoplanet GJ3470b.

From the MCMC result, we obtained the mean density of GJ3470 as $\rho_* = 3.02 \pm 0.71\rho_\oplus$. From our stellar density and Fukui et al. (2013) stellar radius, we obtained the mass of GJ3470 host star $M_* = 0.54 \pm 0.14 \mathrm{M}_\odot$. Then, we can calculated the radius of GJ3470b from the planet-star radius ratio and stellar radius, $R_p = 0.568 \pm 0.037 \mathrm{R}_\oplus$. We adopt the parameter $K = 13.4 \pm 1.2 \mathrm{ms}^{-1}\mathrm{d}^{1/3}$ from Demory et al. (2013) to calculated the mass and density of GJ3470b are $M_p = 13.88 \pm 2.78 \mathrm{M}_\oplus$ and $\rho_p = 0.55 \pm 0.14$ g.cm^{-3}, respectively. In addition, we calculated temperature of this planet, the temperature range in our work is T_{eq} = 512±711 K. From 3.1, shown the Planet-star orbital radius separations of solar system and GJ3470 system.

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From these results, we can conclude that the GJ3470b is a hot sub-Jovian planet. Moreover, we study O-C diagram, from O-C diagram show that there is no major change in orbital period of GJ3470b which may conclude that there is no other massive exoplanet or exomoon in the system. Concerning the short duration of observation (2012-2015), the O-C diagram did not appear to have significant variation. Thus, for the future work, we will propose NARIT to have larger observing time. As result, the detail and better calculate of $(O\text{-}C)_2$ diagram could be obtained.

Table 5.1: Parameters of GJ3470b.

Parameter	Value	Unit
Orbital period	$3.3366499^{+0.0000036}_{-0.0000035}$	day
Inclination	$88.35^{+1.07}_{-0.81}$	Degree
R_p/R_*	0.0843 ± 0.003	-
a/R_*	$13.57^{+1.04}_{-1.10}$	-

Table 5.2: Table show the physical of GJ3470b, Jupiter,and Neptune.

Parameter	GJ3470b	Jupiter[8]	Neptune[8]
Period [Day]	3.3366449	4,332	60,189
Mass [$\times 10^{24}$ kg]	82.899$\pm$1.734	1898.3	102.42
Radius [km]	24635$\pm$5930	71,492	24,764
Semi-major axis, a [AU]	0.264$\pm$0.066	5.20336301	30.0611
Mean density, ρ [g.cm^{-3}]	0.55$\pm$0.14	1.326	1.638

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[8] http://nssdc.gsfc.nasa.gov/planetary/planetfact.html

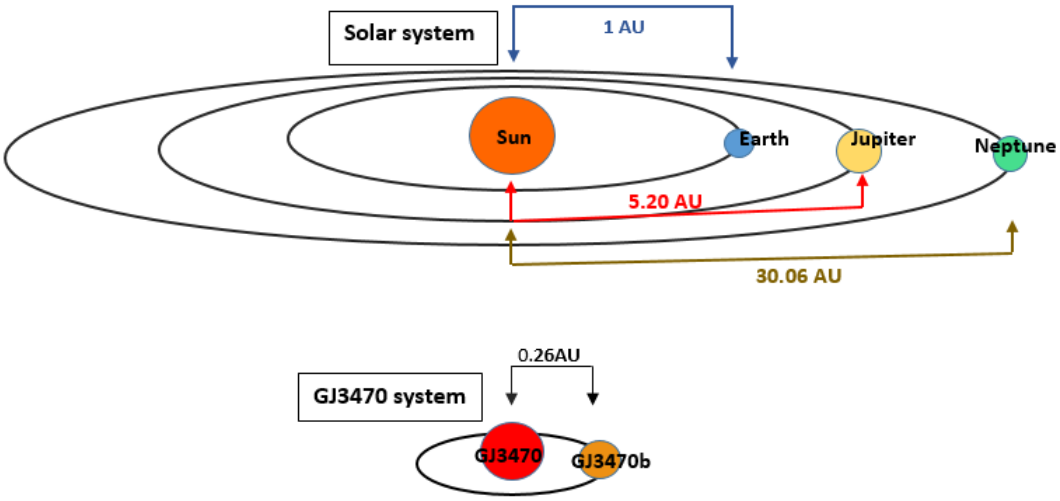

Figure 5.1: Planet-star orbital radius separations of solar system (Top) and GJ3470 system (Bottom). Stars and planets are not scale.

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