

CHAPTER 1

INTRODUCTION

Exoplanets are planet outside of the solar system. The first exoplanets are discovered in 1992 by Aleksander Wolszczan and Dale Frail. Nowadays, there are more than 1900 planets have been discovered. In order to detect exoplanets, several methods have been developed, including radial velocity, gravitational microlensing, direct imaging, pulsar timing and transit methods. In following research, transit method have been used, in order to update planetary parameters of detected planet. From transit observations, orbital parameters of planetary system and physical parameters of planets are obtained, which can determine planet's properties.

GJ3470 is an M-dwarf at RA=7h 59m 05.58s and Dec=+15° 23' 29.5''. GJ3470b, a planet orbiting around GJ3470, was discovered in 2012 by Bonfils et al. (2012). The planet was originally detected by HARPS radial velocity data and is confirmed to be a transiting planet via photometric study. Bonfils et al. (2012) published its mass and radius to be $M_p = 14.0 \pm 1.7 M_\oplus$ and $R_p = 4.2 \pm 0.6 R_\oplus$, respectively, with period $P = 3.3371 \pm 0.0002$ day. Despite the great number of sub-Jovian exoplanets, few of them have been characterize in detail. Therefore, the discover of GJ3470b provide a better understanding of sub-Jovian exoplanet.

Demory et al. (2013) observed GJ3470b using Spitzer observation and found the planetary mass to be $M_p = 13.9^{+1.5}_{-1.4} M_\oplus$ with very low planetary density, $\rho_p = 0.72^{+0.13}_{-0.12} \text{ g.cm}^{-3}$. In the same year, Fukui et al. (2013) observed the planet from several optical bands to near-Infrared photometric band. They claimed that the planet does not have a thick cloud layer. Crossfield et al. (2013) also presented K-band transit spectroscopic and found a flat transmission spectrum suggestive of the presence of high-altitude haze or high metal-rich composition. Nascimbeni et al. (2013) provided updated planetary parameters and improved orbital elements of this planet by using ground based photometry.

Recently, Biddle et al. (2014) derived a new set physical parameter of the planet, $M_p = 13.73 \pm 1.6 M_\oplus$, $R_p = 3.88 \pm 0.32 R_\oplus$, $\rho_p = 1.18 \pm 0.33 \text{ g.cm}^{-3}$ and updated period to $3.3366487^{+0.0000043}_{-0.0000033}$ day from optical to near-Infrared transit photometry. Ehrenreich et al. (2014) presented new simulations of possible theoretical transmission spectrum by using HST/WFC3 observations.

In this research, we used transit method to study exoplanet GJ3470b. From several researches, they observed exoplanets using large-scale telescope. However, in this research, several observations using small-scale telescope were done, in order to compare the result with previous studies. Photometric observations were obtained by Cousins-R filter from 0.5-meter Schmidt-Cassegrain Telescope located at Thai National observation (TNO) and 0.6-meter telescope at Cerro Tololo Inter-American Observatory (CTIO), Chile. Furthermore, we also present O-C diagram of GJ3470b which can be used to analyze the dynamic of its orbital period.

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