# TRANJIT SURVEY OF TrES-2b

## —Try to determine the inclination—

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### 1. Introduction and purpose

If a planet crosses in front of its parent star's disk , then the observed visual brightness of the star drops a small amount. Transit method is a method to catch that drop. This method can determine the planet's radius and inclination.

・The change of the inclination means other ("third") bodies.

・D.Mislis *et al*.(2009) said that the inclination of TrES-2b had changed to a certain direction. On the other hand, Laird M.Close *et al*.(2010) said that there was no change in its inclination.

→We tried to calculate the then inclination of TrES-2b.

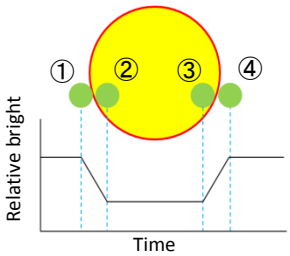


Fig1:A light curve

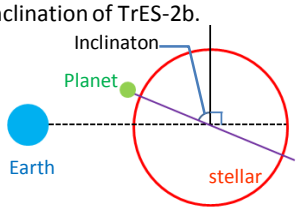


Fig2:The concept of the inclination

①First contact ②Second contact
③Third contact ④Fourth contact

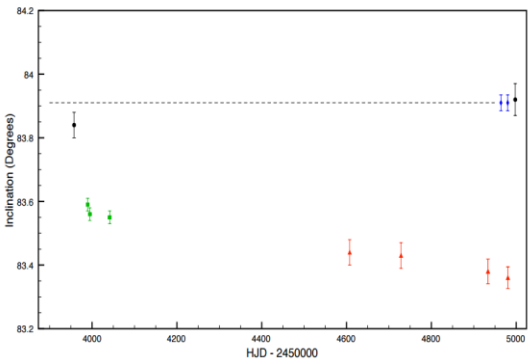


Fig3:The inclination of TrES-2b [3]

* HJD : the days from January 1st B.C.4713

Green points(Holman *et al*.(2007)) } Argument of the changing
Red points(Mislis *et al*.(2009))

Black points(O'Donovan *et al*.(2006)) } Argument of not changing
Blue points(Gilliland *et al*.(2010))

### 2. How to calculate the inclination

Radius of stellar: *R*s Radius of planet: *R*p Semi major axis:α
Inclinaion: *I* Transit duration: *D* Period of revolution: *P*

$$\alpha \sin(180^{o} \times \frac{D}{P}) = \frac{\sqrt{(R_S + R_P)^2 - \alpha^2 \cos^2 i}}{\sin i}$$

Since *R*s、*R*p、α、*P*、*D*is known values, we can know *i* if we get *D*.

### 3. Method and analysis

We observed a transit of TrES-2b on September 18th 2015 using the 0.6m telescope of Nishi Harima Astronomical Observatory employing a R-band filter.

We observed four stars;TrES-2 and three comparison stars.

comparison stars: invariable stars observed to know the change of the primary star's brightness relatively.

We used an image-editing software Makalii ver2.0c made by National Astronomical Observatory of Japan.

### 4. Results andだ consideraton

We achieved the image (in Fig.4) and the light curve (in Fig.5).

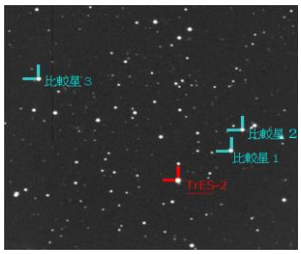


Figure4:Fig.4:the image after photo processing
Comparison star1: 2MASSJ19070093+4917323
Comparison star2: 2MASSJ19065809+2916315
Comparison star3: TYC 3550-1224-1

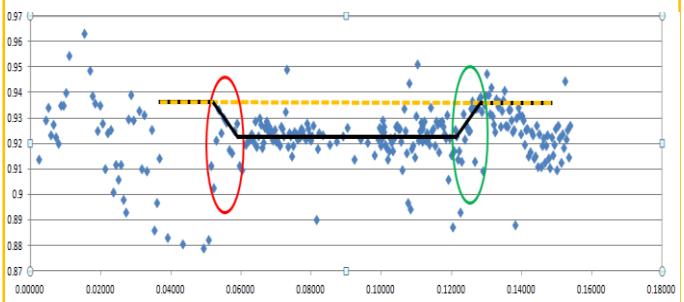


Fig.5:The light curve we got. The vertical line shows the difference between the average of comparison stars' magnitude and TrES-2's magnitude and the horizontal one JD .The yellow dot-line shows the brightness of TrES-2 which does not darken.

As Fig.5 shows:

We calculated the area surrounded by red ellipse for first contact to second contact.(because of the shape of the graph and being close to the expected time shown on ETD)

We calculated the area surrounded by green ellipse for third contact to fourth contact.(as can be clearly seen in the figure)

We estimated the transit duration for 109.7min and the inclination for 84.02° .

### 5. Conclusion

We estimated the transit duration for 109.7min and the inclination for 84.02° .

If the inclination had changed as Laird M.Close et al.(2010) remarked ,the inclination and the transit duration of the day when we observed would have been calculated to 82.89° and 79min.

Our result is not likely to have a margin error of plus or minus 30min.

Now therefore, we concluded that chances are low that the inclination have changed to a certain direction.

### References

[1] D.Mislis et al.2009 "Detection of orbital parameter in the TrES-2 explanet?"A&A,500

[2] D.Mislis et al.2010 "Multi-band transit observations of the TrES-2b exoplanet"A&A,510

[3] Laird M.Close et al.2010 "ON THE APPARENT ORBITAL INCLINATION CHANGE OF THE EXTRASOLAR TRANSITING PLANET TrES-2b"ApJ,714

[4]Exoplanet Transit Database var2.astro.cz/ETD/pred [Accessed 19 September 2015]