Taurus Hill Observatory season 2020/2021 exoplanet review. HATP-38b (Hiisi) and secondary eclipse of the HAT-P-32b exoplanet.

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H. Haukka[1,2], V-P. Hentunen[1], M. Nissinen[1], T. Salmi[1], H. Aartolahti[1], J. Juutilainen[1], E. Heikkinen[1] and H. Vilokki[1]

(1) Taurus Hill Observatory, Varkaus, Finland (veli-pekka.hentunen@kassiopeia.net),

(1) Finnish Meteorological Institute, Space Research and Observation Technologies, Helsinki, Finland

Abstract

Taurus Hill Observatory (THO) [1], observatory code A95, is an amateur observatory located in Varkaus, Finland. The observatory is maintained by the local astronomical association Warkauden Kassiopeia. THO research team has observed and measured various stellar objects and phenomena. Observatory has mainly focused on exoplanet light curve measurements (over 170 measurements so far) [4], observing the gamma rays burst, supernova discoveries and monitoring [2]. We also do long term monitoring projects [3].

The results and publications that pro-am based observatories, like THO, have contributed, clearly demonstrates that pro-amateurs are a significant resource for the professional astronomers now and even more in the future.

Drone images by Esa Heikkinen.

HAT-P-38 and HAT-P-38b (Horna and Hiisi)

The object is located in RA 2h 21min 32s and DE + 32 ° 14 ’46”. From Finland, the object is high in the southern sky only in autumn. In addition, the transit time of the object is such that transit occur quite rarely at night. Considering the uncertain autumn weather in Finland, the probability of detecting a complete transit is quite uncertain in Finland.

Taurus Hill Observatory detected the HAT-P-38b first time on 18 September 2020 and for the second time on 8 November 2020. Based on our observations, the timing of the transit deviated from the forecast by almost an hour. The transit took place clearly ahead of schedule. It is an indication that the rotation time of the exoplanet is possibly slightly shorter than recorded in the original catalog values. In this case, the transit catalog times are no longer valid. Observations made by other observers also confirm this. It is therefore worth monitoring the object to see if such an observed change is indeed regular.

In the first observation the dimming was 13.6 mmag and in the second it was clearly less, only 6.8 mmag. The length of the transit also varied slightly, from 178 minutes on the first occasion to 185 minutes on the second occasion.

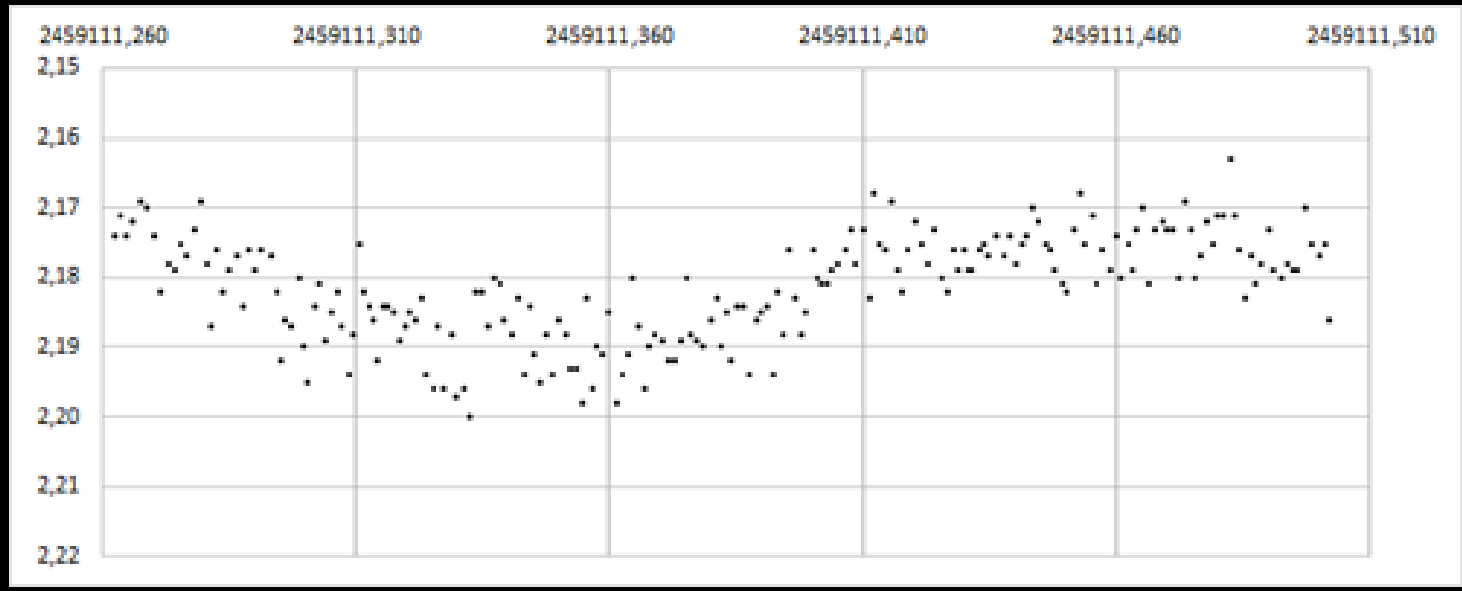

Figure 1: HAT-P-38b transit observed at THO; C-14, Paramount MEII, SBIG ST-8XME. Credit: Taurus Hill Observatory.

Secondary eclipse caused by the HAT-P-32b exoplanet

Last winter, for the first time in Taurus Hill Observatory, a rather challenging exoplanet was observed to transit behind its own parent star. Such an observation was made in Taurus Hill Observatory on February 17, 2021 from the exoplanet HAT-P-32b. Normal transit of a similar object had been observed in Taurus Hill Observatory a few times before. After an observation tip from the Pulkova Observatory, an attempt was made to observe this secondary eclipse in Taurus Hill Observatory. According to forecasts, the subject would have to dim about 3-4 mmag and the duration of the blackout would be about 120 minutes. The fading according to the forecasts was barely visible in the measurements of the Taurus Hill Observatory. Although the detection of a “behind transit” of a star would require better accuracy, at least the measurement results obtained from the light curve, the timing, and the intensity of the dimming were fully consistent with the predictions. Thus, there is strong evidence that the first observation of secondary blackout in Taurus Hill Observatory was real.

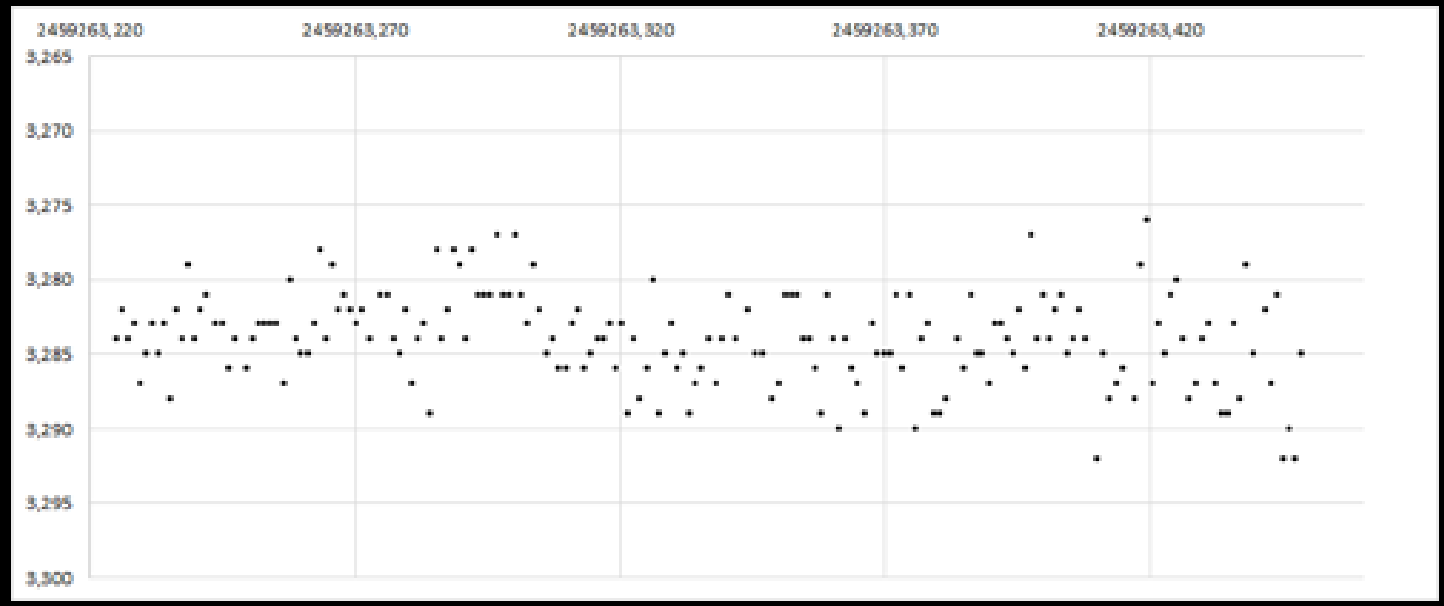

Figure 2: Secondary eclipse caused by the HAT-P-32b observed at THO. Credit: Taurus Hill Observatory.

TESS candidates have joined as new targets

The Taurus Hill Observatory began observing TESS candidates, or TOI objects, in the autumn of 2020. In total, these objects have now been observed 21 times in Taurus Hill Observatory. There have been seven different TESS candidates on the list. These selected targets have been fairly easy to detect, with a change in brightness caused by transits in between 7 and 20 mmag. The findings have been uploaded to the TRESCA ETD database. Although transits have been clearly observable in all observations, the timing of transits or the magnitude of dimming in most of them have been somewhat different from the catalog values, according to measurements by the Taurus Hill Observatory. This is probably mainly due to the huge number of observations of new uncertain objects and the rather modest resolution equipment of the TESS satellite itself. It is very possible that not nearly all of the observed TESS candidates will be confirmed as new exoplanets.

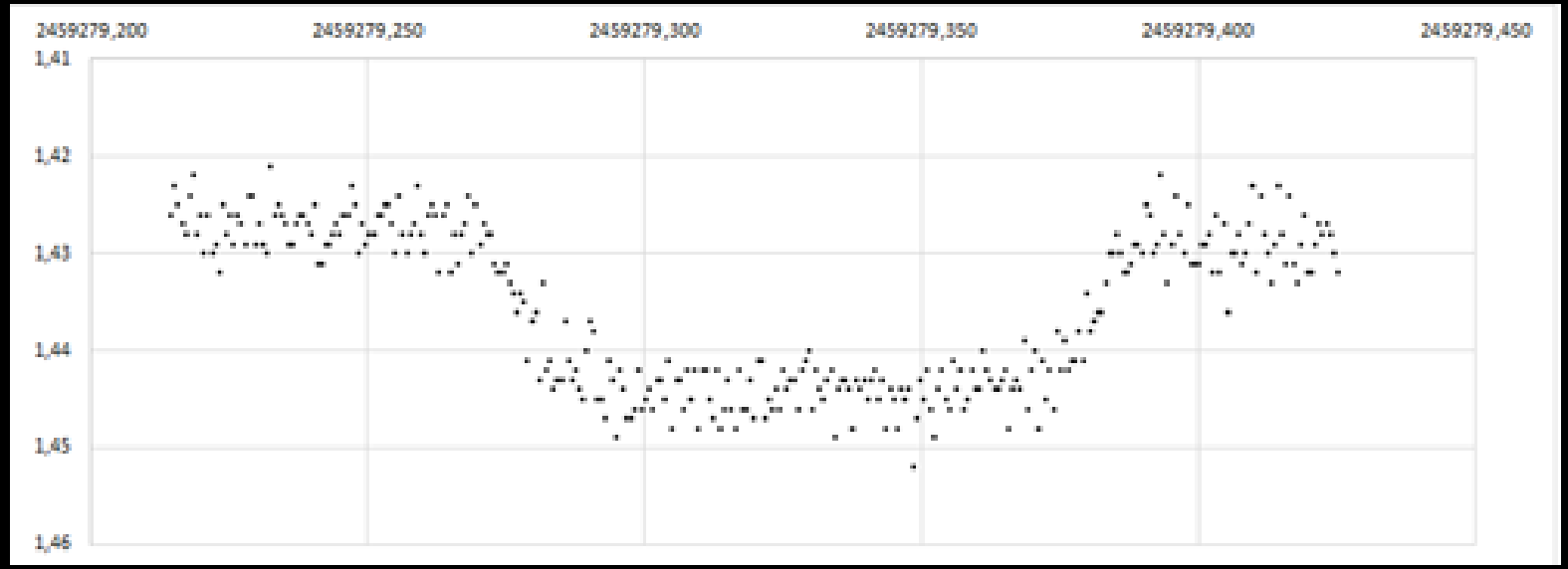

Figure 3: TOI1516.01b transit observed at THO.. Credit: Taurus Hill Observatory.

Summary and Conclusions

Taurus Hill Observatory and other similar pro-amateur based observatories have a good record in field of astronomy and especially in the light curve measurements and photometric monitoring.

The research teams have the knowledge for making a good and high quality photometric light curve measurements. The publication records are one of the good examples from this knowledge. In the future the THO research team aims for more challenging astronomical research projects with professional astronomers and observatories, so please **contact us if you have a measuring campaign or project you would like to include us**.

As a conclusion it can be stated that it is possible to do high quality astronomical research with pro-amateur astronomy equipment if you just have the enthusiasm and knowledge to use your equipment in the right way.

Our Main Contacts and Cooperation Partners

- *Prof. Gregory Laughlin,* Santa Cruz, CA 2006 - 2007
- Amateur astronomer *Bruce Gary*, Hereford (G95), AZ 2007 - 2009
- TRESCA 2009 -
- *Prof. Sergio Messina*, Catania, Italy 2013 - 2014
- *Prof. Eugene Sokov*, Pulkovo (St. Petersburg), Russia 2013 -
- Amateur astronomer *Paul Benni*, Acton, MA, 2017 -

On 2021 Warkauden Kassiopeia celebrates its 20 years birthdays.

Acknowledgements

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References and Links

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[3] **A massive binary black-hole system in OJ 287 and a test of general relativity**; M. J. Valtonen, H. J. Lehto, K. Nilsson, J. Heidt, L. O. Takalo, A. Sillanpää, C. Villforth, M. Kidger, G. Poyner, T. Pursimo, S. Zola, J.-H. Wu, X. Zhou, K. Sadakane, M. Drozdz, D. Koziel, D. Marchev, W. Ogloza, C. Porowski, M. Siwak, G. Stachowski, M. Winiarski, V.-P. Hentunen, M. Nissinen, A. Liakos & S. Dogru; Nature - Volume 452 Number 7189 pp781-912; Nature Publishing Group; 2008

[4] **Transit timing analysis of the exoplanet TrES-5 b. Possible existence of the exoplanet TrES-5 c**; Eugene N Sokov, Iraida A Sokova, Vladimir V Dyachenko, Denis A Rastegaev, Artem Burdanov, Sergey A Rusov, Paul Benni, Stan Shadick, Veli-Pekka Hentunen, Mark Salisbury, Nicolas Esseiva, Joe Garlitz, Marc Bretton, Yenal Ogmen, Yuri Karavaev,Anthony Ayiomamitis, Oleg Mazurenko, David Alonso, Sergey F Velichko; Monthly Notices of the Royal Astronomical Society, Volume 480, Issue 1, October 2018, Pages 291–301, https://doi.org/10.1093/mnras/ sty1615

Links

[1] **https://www.kassiopeia.net**

[2] TRESCA: **http://var2.astro.cz/EN/tresca/transits.php?pozor=Veli-Pekka+Hentunen** (*Exoplanet lightcurves of this presentation*)

[3] **https://www.ursa.fi/proam/yleista-ryhmasta.html** (*general information about pro-amateur activitivites in Finland, pages in Finnish*)

[4] GRB 200829A OA. GCN circular 28318: https://gcn.gsfc.nasa.gov/gcn3/28318.gcn3