ExoClock Newsletter

Dear ExoClock participants,

we hope that you are doing well!

First of all, we would like to welcome the new members!

We send out a newsletter like this at the beginning of every month and you read the past newsletters, watch the past meetings, and have access to other educational material at:

www.exoclock.space/users/material

We also organise meetings dedicated to new ExoClock members. These meetings are held on the Friday just after our regular monthly meeting, and they are not recorded. In these meetings, newcomers have the opportunity to ask questions of any level related to the operation of the website, observations of transits, data analysis etc.

Finally, we have a Slack channel for more direct communication and if you want to join, please send a request at *exoclockproject@gmail.com*.

In this newsletter, we discuss:

1. **Announcements**

    1.1. **1st annual meeting impact**

    1.2. **Second ExoClock publication**

    1.3. **Space data working group**

    1.4. **New addition to the review team**

    1.5. **CMOS working group workshop**

    1.6. **Time-zone changes**

2. **Observations behind the scenes**

3. **Current campaigns**

4. **Highlighted observations**

5. **ALERTS**

1. Announcements

1.1. 1st Exoclock annual meeting impact

The feedback we received for the 1st ExoClock annual meeting is very positive and encouraging for organising such meetings on a yearly basis. Thanks to everyone for giving a presentation and for attending the meeting. All presentations have been recorded and if you haven't watched them yet, we highly recommend it, as they cover a wide range of topics. They will help also new participant to get a spherical perspective of the project.

You can watch all the presentations here:

https://www.exoclock.space/annual_meetings

Please, after watching the presentations, fill the evaluation form which will help us improving our work:

https://forms.gle/Hiixe1fx1wyxhF918

1.2. Second ExoClock publication

We are glad to share with you that the second publication has successfully passed the first stage of the reviewing process and we received very positive feedback and only a few corrections.

While the paper has been officially accepted yet, a pre-print is available now on the arXiv and the second data release is now open.

You can find the pre-print here:

https://arxiv.org/abs/2110.13863

and the data release B (DRB) here:

https://osf.io/wna5e/

Of course, you can share the link with any interested communities.

Congratulations to all the participants for the great work!

1.3. Space data working group

We are announcing for the first time the organisation of the space data working group. The scope of this group will be to evaluate light curves from space telescopes for the ExoClock targets. The members of this group will work with space data and will support the effort of evaluating them.

Note that the tasks can be done only with a computer so there is NO NEED for equipment!

If you would like to participate in this group, please send us a message to share your interest at:

exoclockproject@gmail.com

We will give priority to members that don't have equipment but would like to contribute to ExoClock and get relevant knowledge. A training session will be carried out before beginning the work with the data.

1.4. New addition to the review team

Our review team is expanding, and you may have noticed that your observations are now processed much faster than before! Our new addition is Adrian Jones, an amateur astronomer, and a very active member of ExoClock from the very beginning of the project. From now on your observations will be reviewed by him, too, meaning that you might see him signing some of the messages with feedback or acceptance of the observations.

Adrian, welcome to the review team!

1.5. Camera testing workshop

We plan to hold to a dedicated workshop on testing imaging cameras on Sunday, the 19th of December at 15:00 GMT. The workshop is led by the CMOS working group and Leon Bewersdorff, an active ExoClock member and university student, will be the main presenter.

Anyone that has a camera and or interested in the topic is welcome to participate.

By participating in the workshop attendees will:

- gain an understanding of their camera's functionality
- learn how to achieve the best results using their camera using sensor analysis
- learn key differences between CMOS and CCD sensors, and what to pay attention to when using them.

Moreover, the effect of proper and improper image calibration will be shown, and how to know whether image calibration was successful (or even detrimental!).

The duration will be around 2 hours and at the end of the workshop, you will also have the chance to ask any questions you might have. To join, please register via the following link:

https://www.eventbrite.co.uk/e/exoclock-workshop-how-to-test-my-camera-tickets-204549592337

1.6. Time-zone changes

As the summertime period is now over, we invite you to check the time zone you use in your scheduler. For example, the UK is now at UTC+0.0, while during the summer it was at UTC+1.0. To change the time zone of your scheduler please update your profile at:

https://www.exoclock.space/users/my_profile/

2. Observations behind the scenes

In this newsletter we are introducing the new column "**Observations behind the scenes**" where we will be showcasing one or two observations submitted by you. The aim is to comment some things that can improve your data. For this month the observation we have chosen, sho high noise.

While the schedule is programmed to show you only transits that can be observed by your instrument (transit SNR > 15), there will be cases that you will have light-curves of low transit SNR. One such case can be seen below. The planet is WASP-118b, and the expected transit depth is 8.7 mmag. At the same time, the noise on the light-curve is 4.3ppt which is almost 4.3 mmag, so, as we can see on the plot below, the transit detection is not very strong.
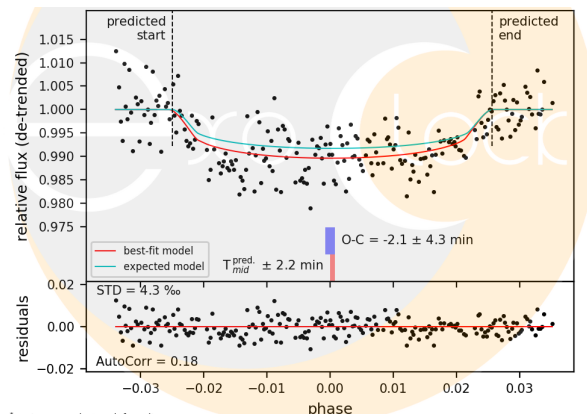
The first think to consider is **how to improve the STD**, which can be found at the bottom-left of the left plot.

1. As always, the first thing to check is your flat frames. If your flat frames have very low signal (less that 2/3 of the full-well-depth) they are increasing the SNR. To improve the SNR you should acquire new flat frames with longer exposure time.
2. The second thing to check is the comparison stars. If you have chosen comparison stars that have much lower counts than the target star, then these comparison stars are increasing the STD. To improve the SNR, you should choose brighter comparison stars.
3. To improve further the SNR, you should experiment with different aperture sizes. The optimal aperture is usually slightly larger or smaller that the default aperture in HOPS or other pieces of software.

If you cannot improve your light-curve, please continue your submission with the airmass or the linear de-trending. Quadratic de-trending may give you better Rp/Rs but there are many cases where this fitting returns an extremely strong trend effect, which usually is not realistic (the red curve of the raw light-curve plot has very high curvature).
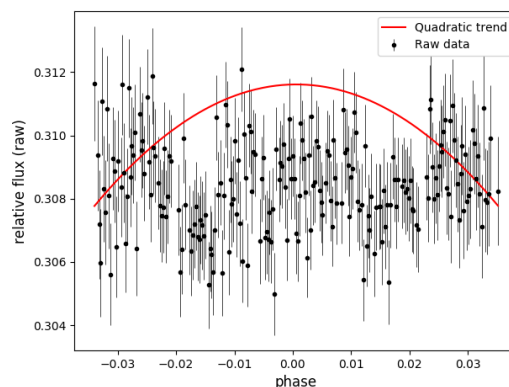
3. Highlighted observations

Last month we received many observations which we can highlight, thank you everyone! We have selected **HAT-P-15b**. A shift of ~**28 minutes** was initially identified by Tönis Eenmäe on the 6th of December 2020. Almost one year later, more recent follow up observations by Robert Roth and Üllar Kivila confirmed this shift. Below you can see the light-curves.

Congratulations for your efforts!
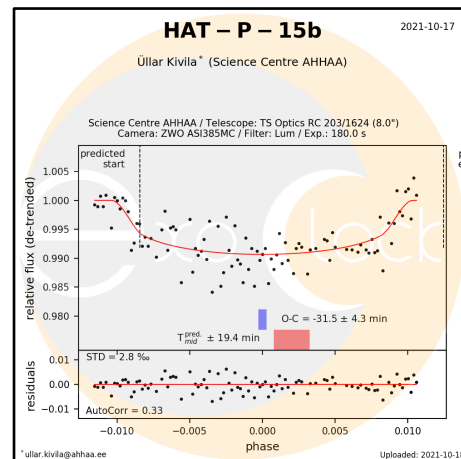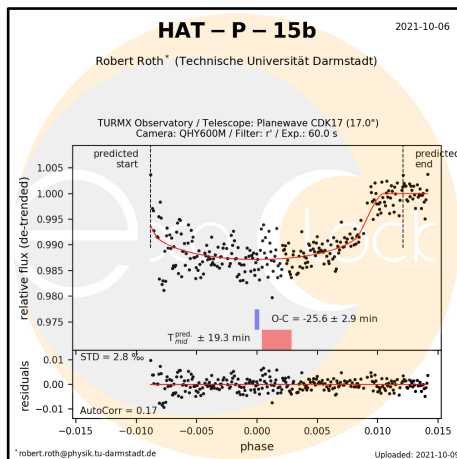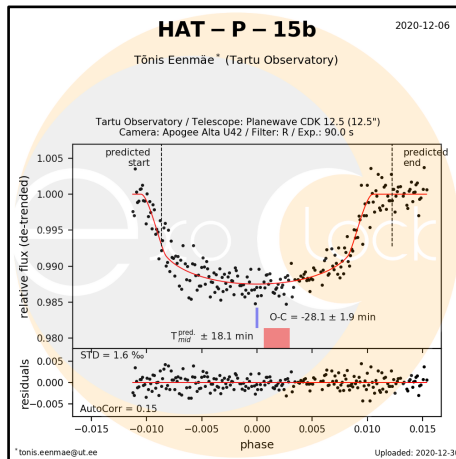
4. Observing campaigns

4.1. TrES-1 b

Just before our annual meeting in September we announce an observing campaign on TrES-1b as the planet was showing signs of a non-linear ephemeris, which is decaying. We received 22 observations since then, which are enough to give us a good precision on the timing of the planet. Overall, the O-C observed in October is **-1.30 ± 0.14 minutes**, in agreement with the assumption that the ephemeris is decaying.

4.2. HD 80606 b

We remind you that in collaboration with the Exoplanet Watch project in the USA we plant to cover the complete transit of HD 80606 b on the 7th of December. Based on three partial observations

uploaded to ExoClock by Alessandro Marchini, Anaël Wünsche and Yves Jongen, observed in 2009, 2016 and 2021 respectively, **we expect the transit to start at 22:50 UT on December 7, 2021**. Given the long duration of the transit, it will not appear on your scheduler, so if you can observe it you should start as soon as the sun is down and continue for as long as possible. More details will follow closer to the date but if you are interested, please book the 7th of December on your calendar from now!

HD 80606 b is a very eccentric (e=0.933), long-period (P~111 days) planet which transits only one or two times per year! The transit duration is 12 hours so to cover a complete transit, we need to combine observations from different locations. HD 80606 b will be observed by the James Webb Space Telescope which is about to be launched in December.

4.3. WASP-76 b

For the next month(s) we decided to also start a campaign on WASP-76b. We do not have many observations of this planet, yet, but combining ExoClock and ETD data in our last publication has shown an unexpected behaviour. We would like to further monitor this planet in case it is affected by TTVs.
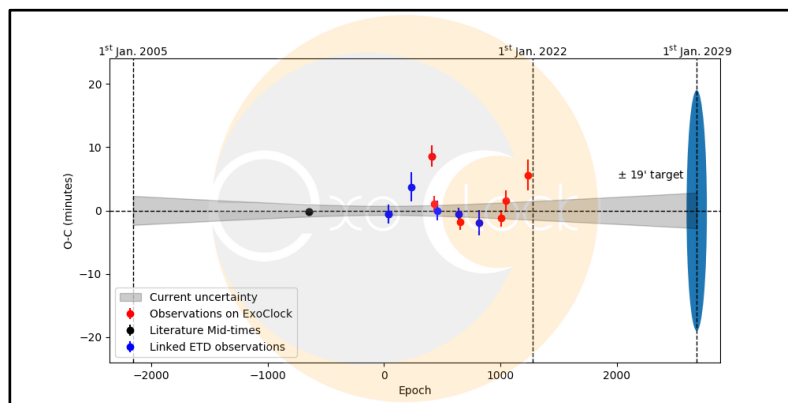
5. ALERTS

Thank you all for observing the alert targets! Please check your personalised alert schedule at:

<div align="center">

www.exoclock.space/schedule/alerts

</div>

for the **ALERT** planets and if you get a clear sky and a long-enough night, you can try observing them! The following targets are in the current **alert system**:

- WASP-71b
- WASP-20b
- KELT-2Ab
- WASP-101b
- KELT-14b
- WASP-100b
- WASP-136b

We remind you that many targets were not in the alert list, before an unexpected shift was identified by you, the ExoClock participants. This highlights the importance of observing targets that are also of low and medium priorities.

Clear Skies,
the ExoClock team