



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. ExoClock publications

1.2. New target prioritisation system & new planets added

1.3. CMOS working group workshop

1.4. Exoplanets plugin on NINA software

2. Observations behind the scenes

3. Current campaigns

4. Highlighted observations

5. ALERTS

1. Announcements

1.1. ExoClock publications

It is official! The second paper has been accepted for publication in ApJS and the pre-print is available now on the arXiv. 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/>

You are encouraged to share the link with any interested communities. The ephemerides of 180 planets have been updated thanks to the collaborative effort of many professional and amateur observers.

Congratulations to all the participants for the great work!

Concerning the next publication and Data Release, we will follow the same plan as previous years. This means that all observations submitted by the **31st of December** will be included in the next publication and Data Release, and the observers will be co-authors in it. Please mark this date and make sure that you submit any observations you have not submitted yet, and resubmit any observations that have been returned to you.

Of course, note that any observations submitted after that day will be part of future publications.

1.2. New target prioritisation system & new planets added

You have probably noticed some updates in your schedulers. Recently we added **205 new planets** including many new **TESS discoveries**. The total number of planets now is **575!**

If you have older observations for any of the new planets, you are welcome to upload them!

We have also implemented a new priority scheme, based on the observing coverage, as defined in the latest paper. This system separates the planets that have been observed many times in the past (e.g. WASP-10b) from others that have only a few observations, but they were discovered many years ago.

So you will notice more high and medium priority targets when you check your schedulers.

Priorities

The target uncertainty has been defined as the 1/12 of the target's transit duration (in 2029).

- **CAMPAIGN**: Planet included in one of the current observing campaigns.
- **ALERT**: An O-C greater than 10 minutes observed by ExoClock participants.
- **HIGH**: Prediction uncertainty greater than the target.
- **MEDIUM**: Last observation older than 1 year, or observing coverage lower than 50%.
- **LOW**: Else, or observed at 3 different epochs in the last 6 months.

1.3. Camera testing workshop – reminder to register

We remind you that there is a dedicated workshop on testing imaging cameras on Sunday, **the 19th of December at 15:00 GMT**. The workshop will be led by the CMOS working group and Leon Bewersdorff, an active ExoClock member and university student.

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!).

Please **remember to register** via the following link:

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

1.4. Exoplanets plugin for NINA- imaging software

During our recent meeting, we had the pleasure to host Nick Hardy who demonstrated the exoplanet plugin in NINA (Nighttime Imaging 'N' Astronomy). The ExoPlanet Plugin can be found here:

<https://nighttime-imaging.eu/>

The plugin is synchronised with the catalogues from ExoClock so it is always up-to-date.

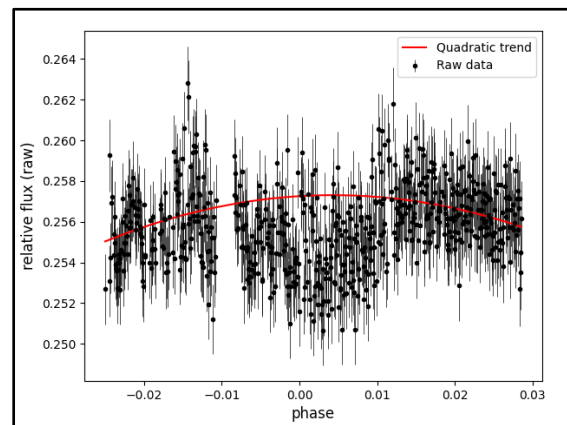
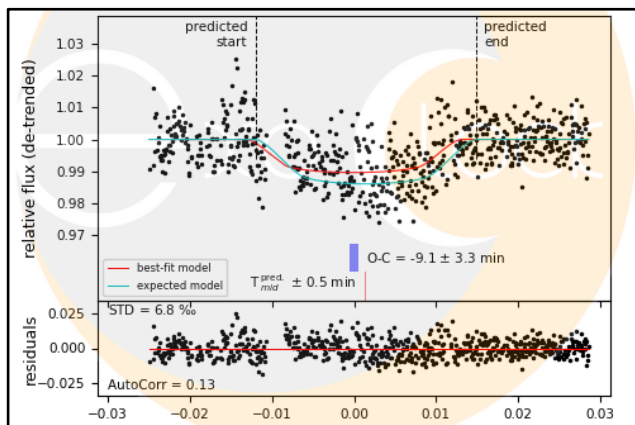
2. Observations behind the scenes

Recently we started the new column “**Observations behind the scenes**” where we are showcasing one or two observations submitted by you. The aim is to comment some things that can improve your data. Here we discuss the case of problematic data points at the beginning or the end of the observation.

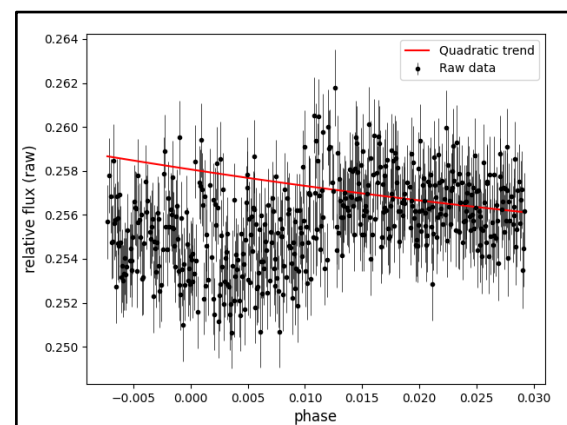
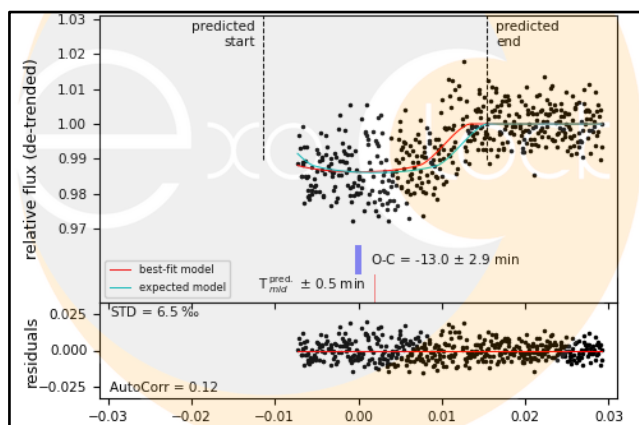
We frequently see data points close to start or the end of an observation that cause problems to the analysis. Usually, this happens to observations that start at high airmass or end at high airmass. The most probable reason for such problems is the atmosphere.

Efficient detrending is based only on the out-of-transit (OoT) observations that you collect. Consequently, any problematic data points before or after the transit can lead to a wrong de-trending, which then causes very high or low Rp/Rs values in the results. In such cases, if you cannot improve the result by changing the comparison stars, then it is better to remove the problematic data-points.

Below, we see an observation where there is a small gap around phase -0.1. Before the gap, the observations are more unstable, causing higher scatter in the residuals. Looking at the raw light-curve plot on the right, we can see that those points at the beginning of the observation, are forcing the de-trending curve downwards. As a result, there is a negative quadratic term (the quadratic trend has a maximum) and the Rp/Rs here is much lower than the expected.



If we cannot improve the result by changing the comparison stars, we can try removing those points before the gap. By doing so, we can see that the STD is reduced from 6.8 to 6.5 ppt, the R_p/R_s is now in agreement with the literature, and the O-C uncertainty is slightly better (from 3.3 to 2.9 minutes), even if we ignored the pre-transit observation. Looking at the raw light-curve plot on the right, we can see that the de-trending curve has now a positive quadratic term (the quadratic term has a minimum).

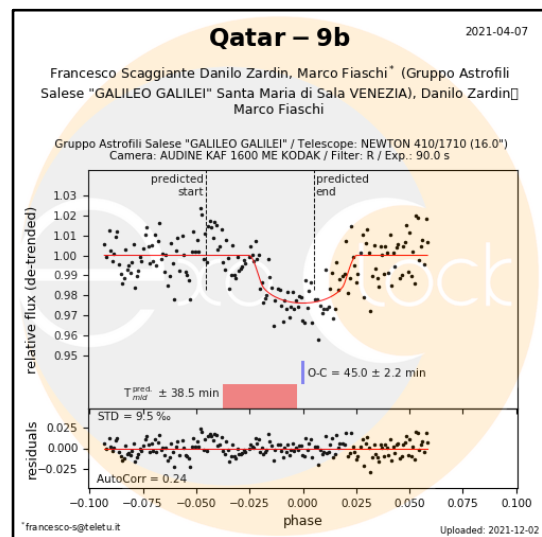
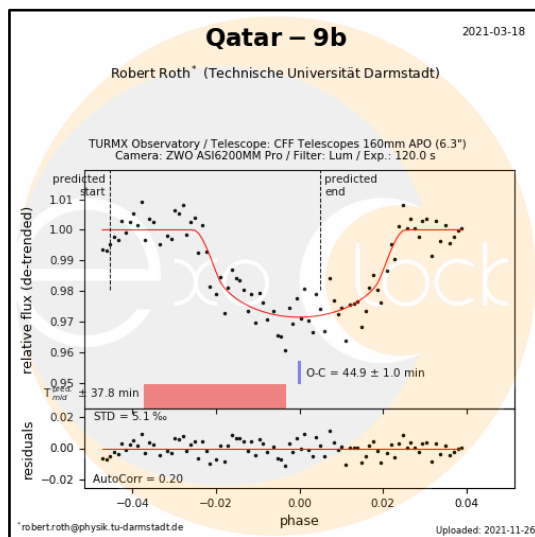
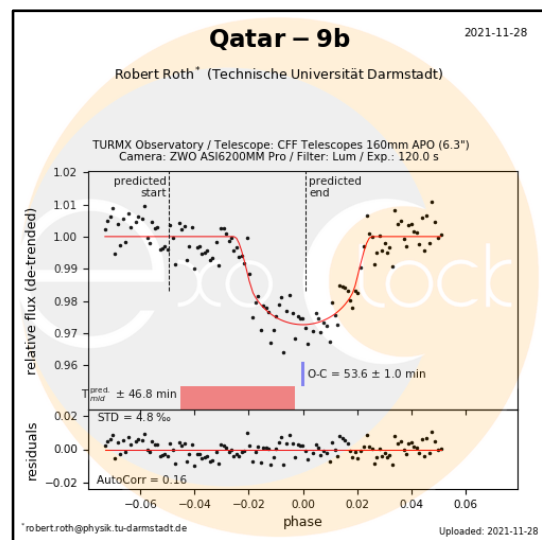
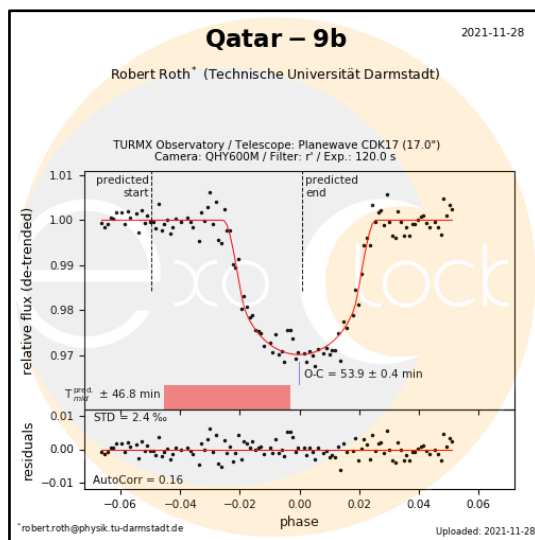
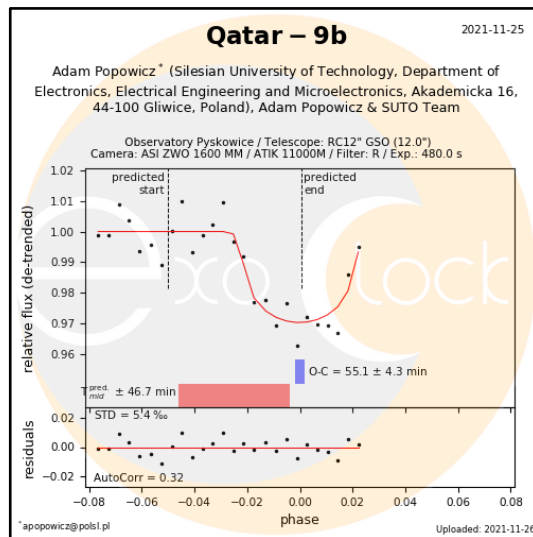


Of course, the ideal scenario would be to have good quality data both before and after the transit, but if this is not possible, then it is better to ignore the problematic data.

3. Highlighted observations

Last month we received many observations which we can highlight, thank you everyone! We have selected **Qatar-9b**, for which a shift of **~55 minutes(!)** was initially identified by Adam Popowicz on the 25th of November. This drift was confirmed both by new observations by Robert Roth on the 28th of November but also from past observations that were now submitted by Robert Roth and by Danilo Zardin and Marco Fiaschi. Below you can see the light-curves.

Congratulations for your efforts!



4. Observing campaigns

4.1. HD 80606 b – TODAY - 7th of December

The transit of HD 80606 b will happen today, 7th of December!

We run the campaign in collaboration with the Exoplanet Watch project in the USA to combine observations from different locations. HD 80606 b is a very eccentric ($e=0.933$), long-period ($P\sim 111$ 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 observations from several places.

The host star, **HD80606**, is a **9th magnitude** G-type star located at **RA 09:22:37.5769, DEC: +50:36:13.434**, while the transit depth is a **10.3 mmag**. Given the above, the event should be observable from any observatory on the **northern hemisphere**, equipped with a telescope of **5 inches or larger**.

The transit will not appear on your scheduler so, you should plan the observation yourselves. 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 ~22:30 UTC on December 7, 2021 and end at ~10:30 UTC on December 8, 2021**. However, there are large uncertainties in this calculation (± 1 hour). Hence, **we suggest start observing as soon as the target is at 20 degrees altitude and continue at least until 03.00 UTC (8th of December), but ideally until the end of the night**.

Indicative observing start times (UTC) for different locations:

Athens	19.30
Barcelona	20.30
Helsinki	19.00
Las Palmas	23.00 (may miss the start of the transit)
London	19.30
Lyon	20.00
Palermo	20.30
Paris	19.30
Prague	19.00
Rome	20.00
Sevilla	21.30 (may miss the start of the transit)

As always, we suggest using an R Cousins filter, but if you do not have one, you can always observe without a filter. The moon illumination today is about 20% so it will not affect strongly the observation.

Concerning the comparison stars, there is a bright star nearby that will be used as a comparison, HD80607. HD80607 is located only 20 arcseconds away from HD80606 so there is no need for a large FOV. In case you need to defocus, please make sure that the two stars are well separated as there are no other good comparison stars nearby.

4.2. WASP-76 b

WASP-76b showed an unexpected behaviour and we started a campaign recently. Based on observations we concluded that there is no TTV observed at the moment. Many thanks for your active responses!

5. ALERTS

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

www.exoclock.space/schedule/alerts

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-117b
- WASP-141b
- KELT-2Ab
- K2-238b
- HATS-41b
- Qatar-7b
- WASP-13b
- EPIC246851721b

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

CHECK this out!

Last month we announced the organisation of the **space data working group**. This is the **last reminder** for those who are interested to register. The scope of this group will be to evaluate light curves from space telescopes (Kepler and TESS) for the ExoClock targets. The members of this group will work with space data and will support the effort of evaluating them.

The only equipment you will need for this work is a computer! For this reason, we will give priority to members that don't have observing equipment but would like to contribute to ExoClock and get relevant experience.

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

exoclockproject@gmail.com

P.S. Note that if you have already sent an email, we will respond to everyone soon.