Issue 29 – Jul 17, 2022

ExoClock Newsletter

Dear ExoClock participants,

Hope you are all doing well!

These days we received the exciting news about the first detailed spectrum of an exoplanet atmosphere obtained by *JWST*. This highlights the importance of studying exoplanet atmospheres and of course, a new era for the exoplanet science is just starting!

We would like to welcome the new members!

We send out a newsletter like this at the beginning of every month, while you can 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 just after our regular monthly meeting. The beginner's meeting will no longer be fixed on the Friday after our regular meeting, because we would like to facilitate participants with different schedules. 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. Note that these meetings are not recorded.*

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 Next ExoClock paper - status and results!

We have submitted the paper to the *ApJS* and we will keep you updated about the progress of the paper. We would like to thank you all for contributing to this effort with your observations. Special thanks also to all the working groups that assisted our efforts (review team, literature team, space data working group, ETD working group). Congratulations everyone!

We will share with you more of the results during our upcoming meeting.

1.2 Old observations on the database

By the end of August, we will clean the archive from past observations that have been inactive for a long time. Please check your observations at:

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

If you have any observations under the "Returned - require reanalysis" or "Uploaded - not submitted yet" categories, please either re-analyse and submit them or delete them.

1.3 Second ExoClock Annual Meeting

This year we are considering holding the annual meeting on a hybrid form (virtual and face-to-face). The location will be at UCL (University College London). You are all invited to attend the meeting either virtually or in-person. We have created a survey to collect responses on your availability before we decide the final dates.

We would appreciate it if you could fill in the form, which has only two questions:

https://docs.google.com/forms/d/e/1FAIpQLScgrfS6w7kKixeMPxZNxx6gjvkaeJ-teyhwK12GYHC0YHPEiQ/viewform?usp=sf_link

Many thanks to those that have already filled in the survey!

By the end of July, we will update you on the final dates and we will distribute a registration page.

1.4 New Ariel article

The second ariel-related with the title "Calibrating Ariel's instruments" has been released! It is written by *Dr. Tim van Kempen,* instrument scientist at the SRON Netherlands Institute for Space Research.

The article is available here:

https://www.exoclock.space/articles/ariel/07_2022_calibration_van_kempen

The article is accessible to everyone; Feel free to share the link with anyone interested in the topic, and share with us your feedback through: exoclockproject@gmail.com

2. Improving the STD of my observations

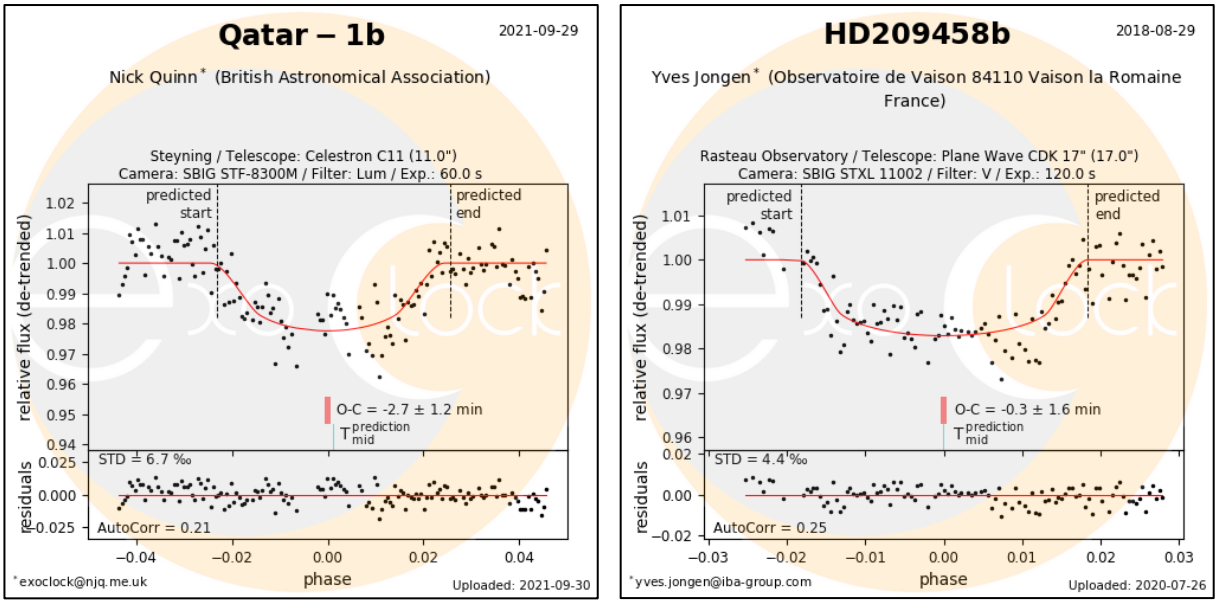
A frequently asked question is: How to improve the STD of my observations? Which value is considered not acceptable?

Generally, to improve the STD – i.e., the standard deviation of the residuals – it is suggested to: 1) use a broader filter, 2) find the best comparison stars (similar magnitude, similar colour, no variability), 3) find the best aperture size (containing the complete PSF but no extra sky).

Regarding the acceptable value for the STD, there is no limitation on the STD value. What really matters is the transit SNR, which is the ratio between the signal (transit depth) and the noise (the uncertainty on the transit depth). Generally, a value higher than 3 is needed to get an acceptable result but the calculation is more complicated as it requires a transit model. **We will add this value on the evaluation page, so that you can understand if your results are of good quality.**

The best initial evaluation you can do about the STD is very simple: **if you can see the transit, the STD is acceptable.**

Below we can see two transits with different values for the STD, but similar in quality. The reason for this behaviour is that while Qatar-1b has a worse STD, the planet's transits is deeper, giving at the end the same SNR.



3. Which planets can I observe with my telescope?

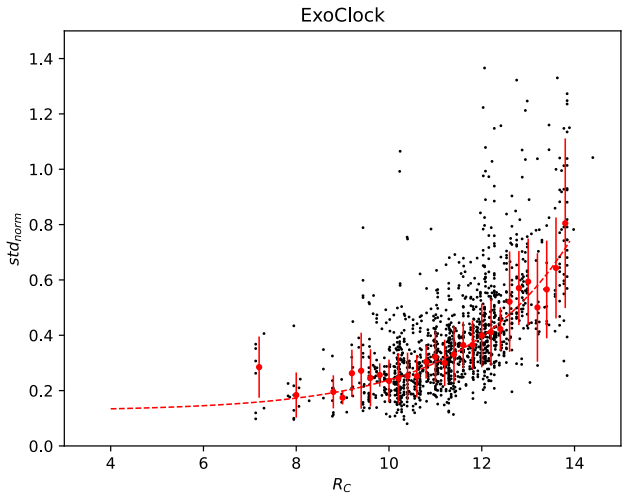
Another frequently asked question is: Which planets can I observe with my telescope?

Well, the best and most reliable way is to check the ExoClock scheduler! However, many of you are interested in observing new planets that are not yet in the system or in checking if a planet is accessible to your instrument in general.

So, to tell if a telescope can observe a specific transit, we need to calculate the expected SNR for this specific combination of planet and telescope. To calculate the SNR we need to know: 1) the transit

depth of the planet and 2) the STD of the lightcurve. The first is easy to find in catalogues or papers but the second cannot be known before the observation.

In our new paper we have implemented a new calibration based on (almost) all the data in our database, in an effort to predict the STD of the lightcurve, based on the size of the telescope and the stellar magnitude. In the figure below er plot the STD for one inch telescope diameter and one second exposure, as a function of the stellar R_C magnitude. The black points represent your observations, and the red dashed curve is an exponential model (the STD is proportional to the square root of the stellar flux, which is an exponential function of the magnitude).



We have also decided to set the limit of the SNR to 6. We have chosen the value of 6 to make sure that the transit will be observable, even if the conditions are not perfect.

By putting all the above together, the estimation for the minimum telescope aperture needed to observe a transit is:

$$D_{min} = \frac{0.135 + 10^{-2.99+0.2R}}{5.1d}\sqrt{\frac{7200 + t_{14}}{900\pi t_{14}}}$$

where D is the telescope aperture diameter in inches, d is the relative transit depth (~ 1000 x depth in millimag) and t14 is the transit duration in seconds.

If your telescope is larger than that, your observation will most probably be successful!

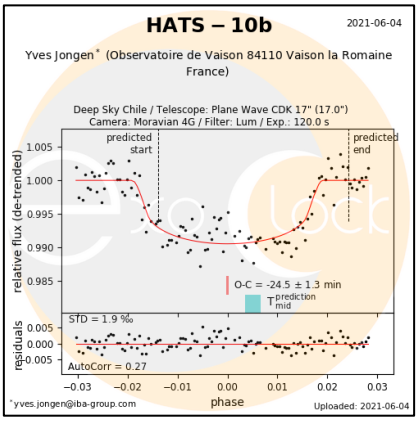
(More details you will find the next ExoClock paper, as soon as it is published!)

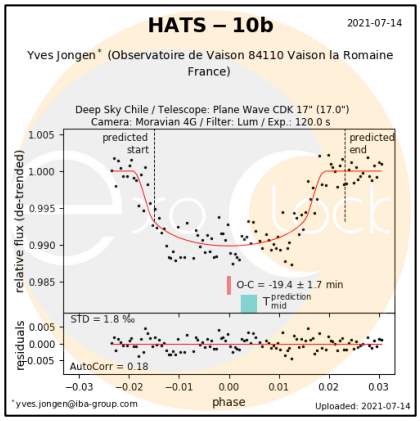
4. Highlighted observations

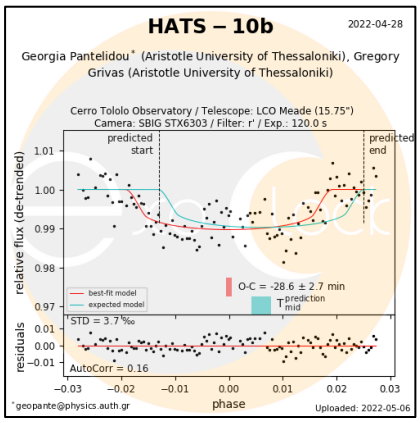
We would like to thank you all for the observations you contributed in June!

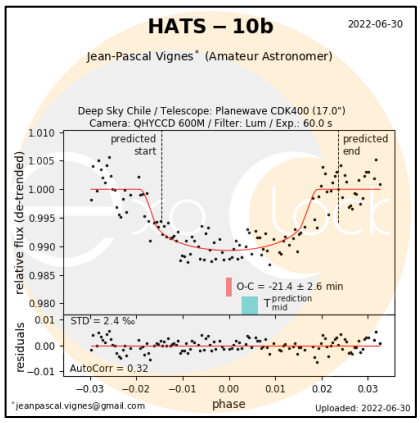
We have selected **HATS-10b,** an ALERT target for which a shift of ~25 minutes was initially identified by two observations by Yves Jongen during 2021. This drift was confirmed recently by more observations by Georgia Pantelidou, Grigoris Grivas, Jean-Pascal Vignes and Yves Jongen.

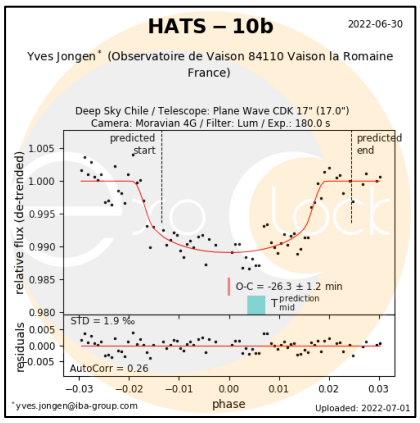
Congratulations for your efforts!











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 remain in the current **alert system**:

- WASP-7b
- WASP-71b
- WASP-147b
- WASP-192b

- WASP-7b
- WASP-68b

Please remember 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