



ExoClock Newsletter

Dear ExoClock participants,

we hope that you are doing well!

First of all, we are welcoming the new members! To engage with the community, we sent out a newsletter like this at the beginning of every month and we hold a regular meeting on the last Thursday of every month. 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 have a Slack channel for more direct communication and if you want to join, please send a request at exoclockproject@gmail.com.

As our community is growing, more and more new people are joining – both professionals and amateurs – with very different levels of experience. For this reason, we decided to start organising an extra monthly meeting dedicated to the newcomers. This meeting will be held at the beginning of every month, and it will be different from the regular ExoClock meeting as it will not have an agenda and it will not be recorded. In this meeting newcomers will have the opportunity to ask questions of any level related to the operation of the website, observations of transits, data analysis etc.

We would like to invite all the ExoClock participants that have joined the project recently, (or those who have not attended our regular meetings before) to the **first ExoClock Beginners meeting next week**. In order to find a common day that suits the majority, we kindly ask you to fill in your availability in the following link:

https://doodle.com/poll/vpgzqaku9r6264i5?utm_source=poll&utm_medium=link

We will send a separate message with the date and the link of the first meeting as soon as we have collected your responses. We note again that this will be separate from our regular monthly meeting, and it will be dedicated to newcomers and beginners in exoplanet observations.

In this newsletter, we discuss:

- 1. ExoClock virtual meeting – May 2021**
 - 1.1 Announcements**
 - 1.2 Publication updates**
 - 1.3 Working groups updates**
- 2. Annual ExoClock meeting**
- 3. ALERTS**

1. ExoClock virtual meeting – May 2021

Thank you all for attending the meeting and sharing your ideas/updates with us! For those who could not make it, this meeting, together with all the previous ones, is accessible from:

www.exoclock.space/users/material

During this meeting we discussed several topics and here we briefly share the main points:

1.1 Announcements

○ Photos

Please send us photos with your equipment (telescope and cameras) and we will share this with the general Ariel Outreach group. The group plans to share within its channel some of these images to raise awareness about ExoClock and encourage other observers to join the project. The idea is to show the variety of set-ups that can successfully conduct transit observations.

Send us your images at exoclockproject@gmail.com!

○ Outreach

If you have done an outreach activity related to ExoClock, please share it with us and we can share it with the rest of the community! Or, if you are planning to have an activity / event let us know if you would like any support.

We would be very happy to assist your efforts with outreach/educational material!

○ Wiki page

We are starting to create a dedicated page with guidelines on navigating through the ExoClock website to facilitate new members. Moreover, this page will include frequently asked questions or tips regarding observations, data analysis and upload of light-curves to the website. It will be really useful to get any notes, tips or experience you might have regarding the use of the ExoClock website.

If you would like to support the development of the Wiki page, please send us any material you want to share at exoclockproject@gmail.com!

1.2 Publication updates

○ Info

We have completed the writing of the second publication, and we have sent the final document to the co-authors for review. This publication includes ~1600 observations conducted by ExoClock participants, ~2500 mid-time points collected from the literature, and 18 observations provided by

ETD. This data was used in combination to update the ephemerides of 180 planets. The author list includes almost 100 co-authors from whom, 65% are amateur astronomers. Thank you all and congratulations! Below you can find some of the results we shared.

○ **ExoClock network – updated capabilities**

The figure below shows the updated capabilities of the ExoClock network based on the performance so far. As you see, the majority of the current planets (85%) is accessible by the telescopes of the ExoClock participants while the few larger telescopes are capable of observing more difficult targets with lower S/N. Currently, there are 280 participants out whom 80% are amateur astronomers. There are 300 telescopes registered with sizes ranging from 6 to 40 inches and 80% of them are smaller than 17 inches. In this second publication, most observations obtained with small telescopes, highlighting the capabilities of the small- and medium-sized telescopes for performing exoplanet transit observations.

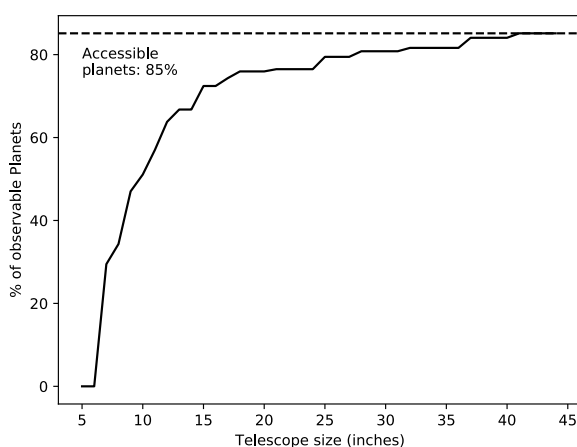


Figure 1: Cumulative percentage of observable planets as a function of the telescope size.

○ **Data quality**

The figure below is indicative of the high-quality data provided by the observer. 90% of the light curves give O-C values with a precision better than 3 minutes.

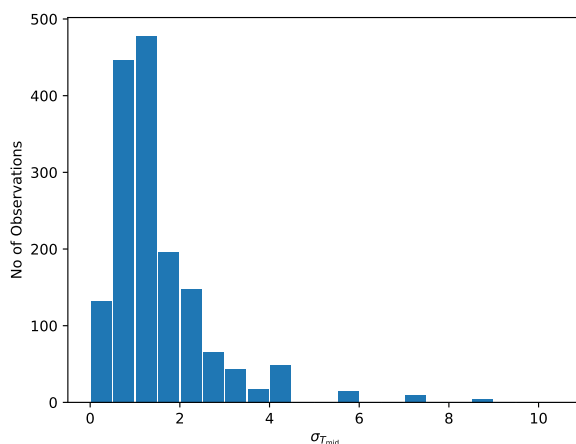


Figure 2: Distributions of the achieved uncertainties on the mid-transit time from all the ExoClock observations.

○ Final results

This ExoClock publication provided an improvement of uncertainty for all 180 planets. A quite large fraction of the planets (40%) had ephemerides with higher uncertainties or biases than those previously considered. The remaining 60% planets had reliable initial ephemerides but still their ephemerides were improved. Moreover, the majority of them still have limited observations and drifts might appear in the future. Hence, continuing their monitoring is necessary. In total, for 65% of the planets the uncertainty reduced to half which is again highlighting the importance of ExoClock observations for planning future observations.

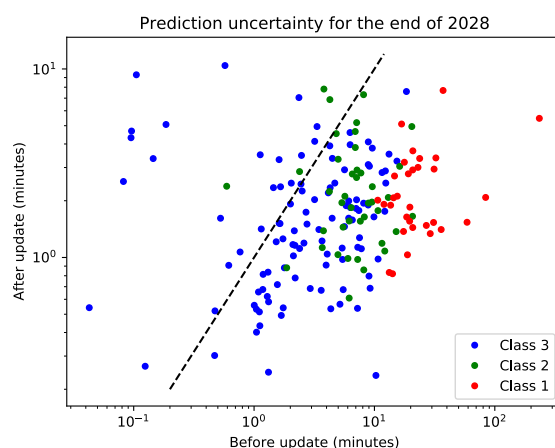


Figure 3: New prediction uncertainties vs old prediction uncertainties. Planets on the right side of the dashed line have their predictions improved.

○ ExoClock – ETD collaboration

This publication includes also the first products of the collaboration between ExoClock and ETD. We are very happy since such collaborations are crucial to make the best use of resources. Below you can find some details about ETD and how our mutual work is organised. You can also find a introductory section to ETD at the end of this newsletter, kindly provided by Filip Walter.

From now on, ExoClock project also incorporates and uses for analysis transit light curves from the ETD under the following conditions, agreed between the two projects: 1) The light-curves are of data quality 3 or better. 2) The light-curves have not been uploaded to ExoClock. 3) The light-curves have been re-analysed by ExoClock standard procedure. 4) Only results are consistent with other observations are used to perform analysis of target ephemerides. 5) The observers have given explicit consent to use the data. The selected light-curves will then be used in the ExoClock publications, and the observers will be included among the co-authors. Finally, the raw data will not be hosted on the ExoClock database, a link to the ETD database will be provided instead.

In this paper, 18 transits from the ETD, observed between 2014 and 2019, were used. While it seems to be a small number, that is only the beginning of a long-term collaboration. The usefulness of our collaboration is demonstrated by the planet HAT-P-55b, where ETD transits tripled the observation timeline. The person responsible for the ETD - ExoClock collaboration is Filip Walter, an ETD admin and the ExoClock local contact for the Czech Republic.



Figure 4: Workflow of the ExoClock – ETD collaboration.

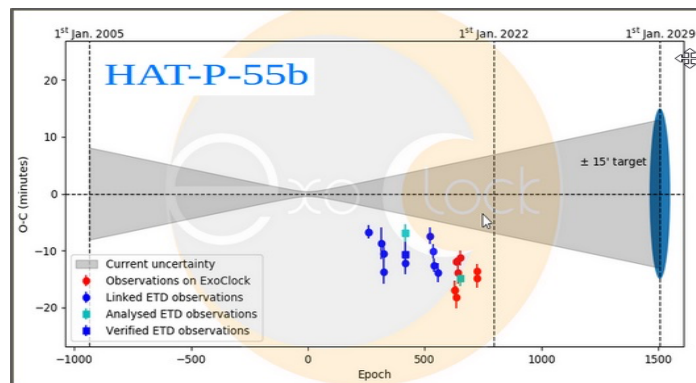


Figure 5: Transits provided by ETD in combination with the observations of ExoClock for HAT-P-55b.

1.3 Working groups updates

During our recent meeting, members of the working groups gave brief updates on the current status of their work. If you are interested to find out more about the working groups, you can join the dedicated slack channels. We remind you that the working groups are:

- **Synchronous Observations Working Group**, coordinated by Alessandro Nastasi
- **CMOS Working Group**, coordinated by Roland Casali and David Rees
- **Multi-colour observations Working Group**, coordinated by Steve Futcher

2. Annual ExoClock meeting

We would like to establish an annual ExoClock meeting (currently online) towards the end of July. In this meeting you, the participants, will have the chance to share your work related to exoplanets, and as a community we will have the opportunity to interact more. We are thinking of arranging separate sessions for observing, data analysis and theory in order to have more dedicated discussions. You are welcome to join any part you want based on your interests/time and you are invited to also present your work/ observatory. Certainly, it will be a good place for the working groups to share their work so far and get some feedback.

Before we proceed to the organisation of the virtual meeting and send details on registration etc, we would appreciate it if you could let us know your availability for the end of July. Please fill in the two most convenient days for you through the link below. Note that the times are only indicative.

https://doodle.com/poll/htm3am4rbvm2xcur?utm_source=poll&utm_medium=link

3. ALERTS

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-38b
- NGTS-2b
- WASP-38b
- WASP-29b
- WASP-100b
- Kepler-5b
- KELT-10b

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

The Exoplanet Transit Database (ETD)

by Filip Walter

Many of you are already aware of the existence of Exoplanet Transit Database (ETD), some of you have been, and still are, contributing to it. Launched in 2009 by the Variable Star and Exoplanet Section of the Czech Astronomical Society, this pro-amateur project serves both amateur and professional community as an archive of observations and a tool for education and observation planning.

The ETD web page provides transit predictions, its own transit data fit, automated data-quality rating algorithm. Observers can register, upload light curves and maintain an observation log via related project TRESKA. O-C diagrams of mid-transit, transit duration and transit depth for each object are automatically plotted based on performed data fits.

There are roughly 10-20 publications referencing the project each year, and, as of May 2021, the database contains 9589 individual light curves made by amateur and professional observers from all over the world.

Apart from ExoClock targets the database collects observations of many other transiting exoplanets as well as KEPLER and TESS candidates. Thanks to the ExoClock - ETD collaboration, no exclusivity of the transit data is required, and you can upload your light curves to both projects. You, an amateur observer or a professional, are wholeheartedly invited to take part in the ETD project. To register as an observer and for more details, please see the ETD website:

<http://var2.astro.cz/ETD/contribution.php>

Current or new observers and researchers interested in additional newsletters and support, please register via ETD community form:

<https://forms.gle/V4DSTexAbSYZvwKs9>

You may visit our community map here: <http://cmap.astro.cz/app/?mapId=etd>

Project administrators: Filip Walter, Kateřina Hoňková, Ondřej Pejcha and Luboš Brát

E-mail: ETD@astro.cz

ETD website: <http://var2.astro.cz/ETD>

Czech Astronomical Society - Variable Stars and Exoplanet Section: <http://var2.astro.cz>