



ExoClock Newsletter

Dear ExoClock participants,

Hope you are all well and safe. May has been an equally productive month to April, increasing the total number of observations to over 800, well done everyone!

At the moment we are preparing the first ExoClock publication by re-analysing most of your past observations. We are going to contact soon all of you who have provided these observations, to confirm your affiliations. Note that the current list includes observations submitted before the 15th of April. This deadline was decided early this year, to allow the necessary time to re-process all the data in time. Observations submitted later will be included in our second publication!

Many thanks again to those that uploaded mid-time literature values. This is very helpful! If you have chosen a planet, please complete any literature uploads, or let us know and we will arrange the completion.

In this newsletter, we have performed a major update of the ExoClock database:

- to reduce mistakes and incompatible entries from other catalogues and from the literature
- to improve the appearance of the website
- to further assist you with the analysis process, and
- to apply a “live” update of the scheduling based on the current observations

We would like to thank all of your positive comments on the new website. This is the result of our collaboration and we are grateful for all the feedback you have given us towards applying these new features.

Website updates

➤ Catalogue

The ExoClock catalogue has been updated to include some corrections to values found in other catalogues and in the literature. You will find all the values for a planet’s parameters on its dedicated page (as usual), including now uncertainties and references to all the papers used.

Special thanks to Martin Crow, Marc Deldem and Adrian Jones who identified the problem with Kepler-447b (the true depth is ~3 mmag while the database was suggesting ~26 mmag, due to a wrong value of the semi-major axis). It is important to fix any such issues as early as possible to avoid problems in the future observation planning. Please let us know as soon as possible if you find similar problems in the records.

➤ **Observations database**

We are now able to support the ordering of the observations list per observer or per planet, as you requested a long time ago. Visit the same address <https://www.exoclock.space/database/observations>

to see a summary of the observations published on the website so far.

➤ **Uploading observations**

The analysis performed during upload now include much faster version of the MCMC fitting, giving more stable results and much closer to the final analysis.

After uploading, you will see a number of diagnostics together with your light curve. These include: a) a comparison between the expected and the observed mid-time, b) a comparison between your O-C and the O-C from other ExoClock observations, c) a comparison between your Rp/Rs value and the value in the literature, and d) a comparison between your Rp/Rs value and the value from other ExoClock observations.

The diagnostics are marked with blue or red to indicate an agreement or not, respectively. The agreement or not is judged from the differences between the values over the uncertainty on the difference, with 3σ being the limit (3σ means that the uncertainty on the difference is 3 times smaller than the difference itself). You should not be discouraged to submit any observations if you see a significant time shift (this is what we are looking for!) but take extra care to check if the Rp/Rs value is consistent with the literature and/or other ExoClock observations.

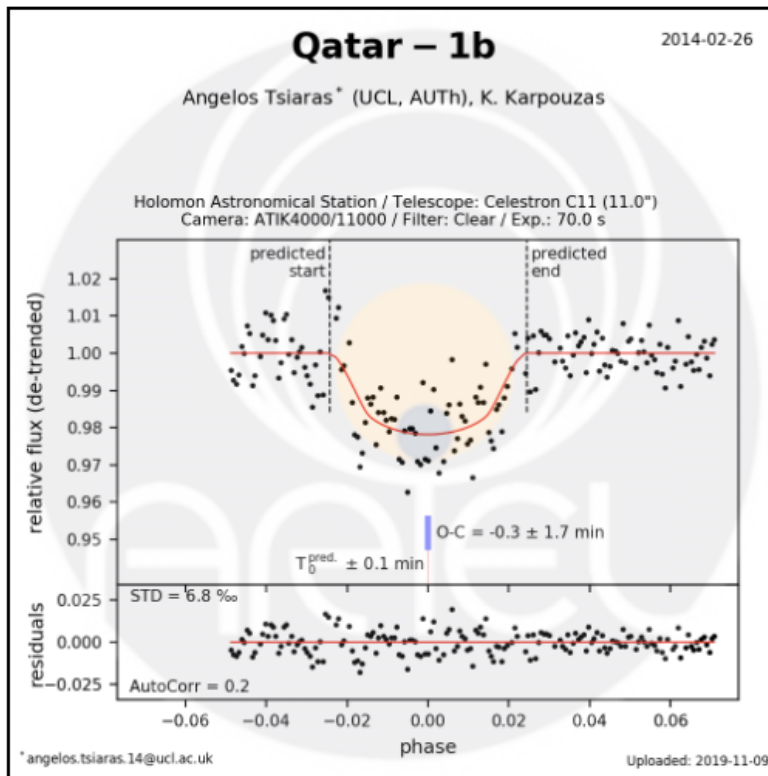
In addition, you will see a plot with your raw light curve and the airmass correction applied. This may not be the best de-trending method as other options are the quadratic and the linear trend. However, you don't need to worry about this, as we will check it after you submit.

A screenshot on the next pages shows an example of an uploaded light curve with the diagnostics that you will be seeing from now on.

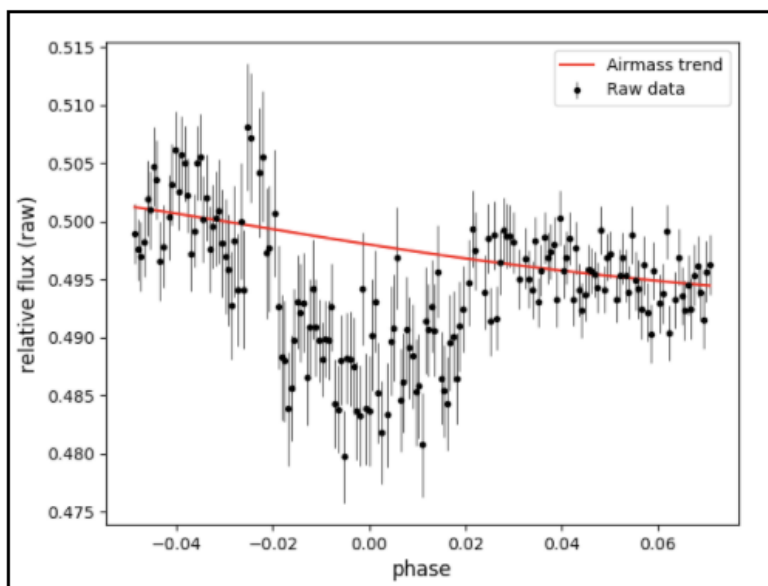
➤ **Scheduling**

We have implemented an automated update of the priorities based on the current observations, so you will see far less planets indicated as ALERT, HIGH or MEDIUM priority. This is the result of your work! As more and more observations are coming in for a specific planet the priority decreases.

For those observers with a significant number of observations, we have adapted the noise expectations based on the real light curves. This means that your schedule will include more "difficult" targets (greater magnitudes, lower depth), allowing us to cover a larger percentage of the catalogue. The noise expectations will continuously get updated as you submit more observations.



	T_0 (BJD _{TDB})	O-C (min)	R_p/R_s
Prediction	2456715.4914 ± 0.0001	-	0.1463 ± 0.0006
Other ExoClock results	-	1.05 ± 0.07	0.146 ± 0.0003
My results	2456715.4912 ± 0.0012	-0.3 ± 1.7	0.142 ± 0.005
Comments	In agreement with the prediction (-0.2σ , without taking into account the prediction uncertainty)	In agreement with ExoClock (-0.8σ)	In agreement with the literature (-0.9σ) In agreement with ExoClock (-0.8σ)



Key points from the third web meeting

Many thanks for participating in the recent meetings; we will continue organising more such discussions in the future, as they are very fruitful. For those who did not have the chance to join so far, the recorded meetings, as well as all newsletters are accessible through your account at:

<https://www.exoclock.space/users/material/>

Note that this material is only available to registered participants and thus, it is not allowed to use it for external purposes or share it with others.

During the third online meeting, these were the main topics discussed:

➤ *How to identify the target FOV*

We shared some tips on identifying the target in the FOV. Certainly, if you don't have an automated way to verify your FOV, it is useful to mirror/flip your image and also increase the exposure time to allow fainter stars to be observable. The above can help you to match your image with the maps.

In addition, many members shared information on software that can be used to automatically plate-solve the FOV. A variety of them were mentioned and you can find relevant information in the video.

➤ *How to evaluate the fitting*

This is one of the most commonly asked questions and for sure, the most complicated. This is why we keep discussing it and to further support you in this process we have included the diagnostics on the website during upload, as described above.

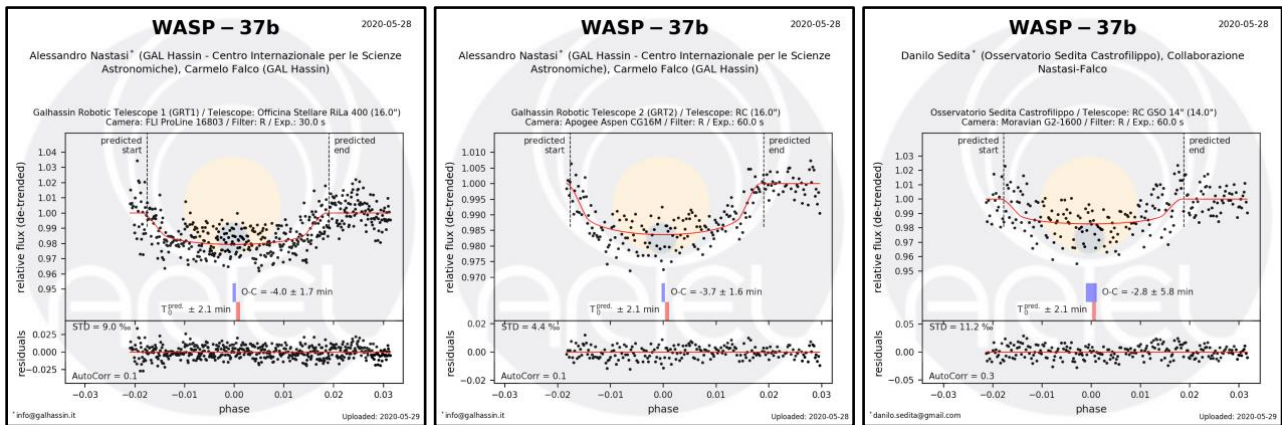
➤ *Observing with DSLR cameras*

This is an interesting topic for many observers especially for those that don't have CCD cameras. Since our current knowledge is limited, any additional information is valuable to develop best observing & analysis strategies regarding this. Cédric prepared a very nice presentation and he shared with us some of his experience on this topic. If you are interested, you can watch the last part of the meeting. It is worth noting that transits are definitely observable with DSLR cameras.

We are collecting information to better understand the behaviour of these cameras and define an optimal strategy to obtain and analyse such observations. Please, send us any comments or feedback on tests & observations you are doing,

Highlighted observations

Recently, many simultaneous observations have been conducted. This will give us the opportunity in the future to organise coordinated observations with the aim of increasing the time precision and also recording the transit of more "difficult" targets. This month (on the 28th) we had the first observation of WASP-37 b on ExoClock, and this was in fact a triple observation! Alessandro Nastasi observed the transit with two instruments simultaneously, located in Sicily, Italy, while a few kilometres nearby, Danilo Sedita was also observing the same transit. The results are in perfect agreement, giving an overall O-C of -3.8 ± 1.1 minutes.



Congratulations Alessandro and Danilo for the great effort!

ALERTS

Thanks to everyone who observed some of the **Alert targets** during the last month. WASP-103b was a target in the Alert system and now we have enough observations to verify the ephemeris and this is thanks to your vigorous activity. The following targets (including old and new ones) are in the **alert system** at the moment. Please check your personalised alert schedule and if you get a clear sky, observe them!

<https://www.exoclock.space/schedule/alerts>

- HAT-P-6b
- HAT-P-49b
- HAT-P-55b
- K2-30b
- K2-140b
- K2-237b
- KELT-15b
- NGTS-2b
- WASP-13b
- WASP-26b
- WASP-31b
- WASP-54b
- WASP-56b
- WASP-83b

We remind you to send us at exoclockproject@gmail.com:

- Your feedback on the website
- Suggestions for new features
- Questions on the observations or the analysis
- Ideas for topics you would like to see in the newsletters

Stay well and healthy!

Clear Skies,
the ExoClock team

CHECK this out!

ExoWorlds Spies is now available in **French!** <https://www.exoworldsspies.com/fr/observers/>
Share it with any interested French-speaking audiences!

Many thanks to **Mario Morvan** from UCL who translated all the material to French, in an effort to expand the project to French-speaking people. If you are interested in translating material in your language, send us an email and check the Citizen Science Translation Hub website for details:

<https://citscitranslate.wixsite.com/citscitranslate/exoworlds-spies>