Issue 41 – Feb 20, 2024

ExoClock Newsletter

Dear ExoClock participants,

Hope you are all doing well!

We would like also 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 organise meetings dedicated to new ExoClock members**. These meetings are held just after our regular monthly meeting. The beginner's meeting is usually held on the Friday after our regular meeting or the week after. In these meetings, newcomers can 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, follow this link:*

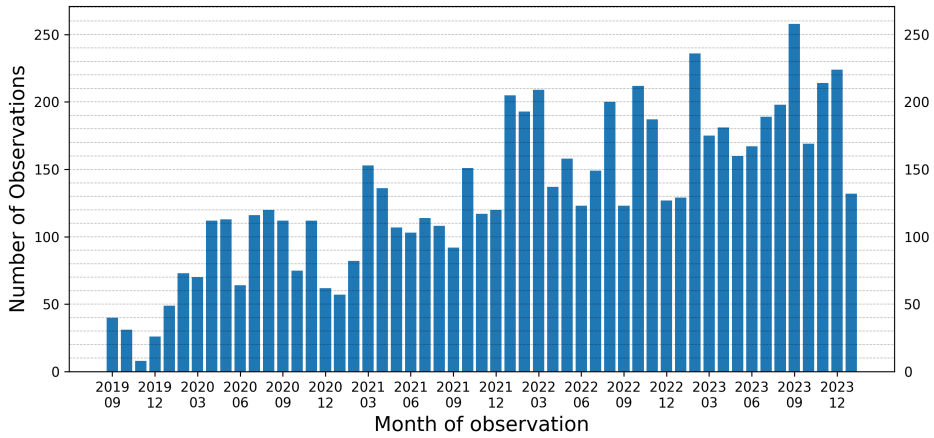
https://join.slack.com/t/exoclock/shared_invite/zt-1t5l875v6-x0s8s553kT8nbCvbyo7boA

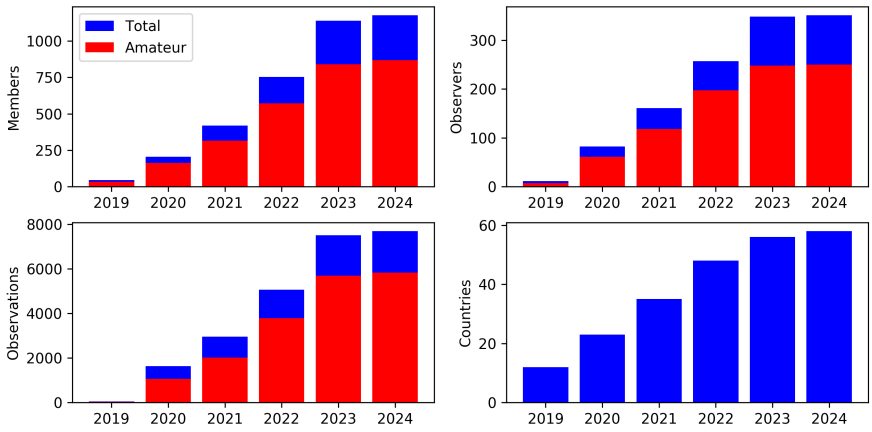
In this newsletter, we discuss:

1. Announcements

1.1 Statistics from last year (2023)

Thanks everyone for joining and continuing this journey of research and exploration with ExoClock! Since its launch back in 2019, the number of observations and observers, and as you can see below, amateur observers constitute the majority of the project.





1.2 Recordings from the 3rd annual meeting

If you have missed our 3rd annual meeting or want to watch again some of the presentations, the recordings are now all available on the website. You can find them here:

https://www.exoclock.space/annual_meetings

Presentations include talks by Ariel scientists, ExoClock partners and participants, and members from our working groups.

We also value your opinion on our meeting. Please take a moment to share your feedback here:

https://forms.gle/MiJZgnTTXxDUSn1EA

1.3 New HOPS version available

The new version (V3.2.0) is available and you can find it here:

https://www.exoworldsspies.com/en/software/

The version includes plate solving which means that you don't need to struggle finding the target!

1.4 Next ExoClock publication

For the next publication, we included data from two years (2022 & 2023), with an initial release expected during spring. A preliminary list of the observers that will be co-authors in the next publication can be found here:

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

We would like to kindly ask you to send us a message if there are co-observers that should be in the co-author list as soon as possible.

We also remind you to fill your **author information box** or update it with new information if something has changed, here:

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

Our teams are working hard on the analysis of all data. We expect to send a first draft within the next weeks.

1.5 Remote Observing activities

ExoClock Unlocked

The activities of the ExoClock Unlocked 2024 call have started! We have received over 100 applications from all over the world! The applicants will be divided in teams of 3-4 people. If you have sent as an application and the task, then you should have received an email with the next steps. We would like to thank again Las Cumbras Observatory (LCO) and Telescope Live for offering observing time to capture important exoplanet transits for ExoClock.

The activities are coordinated and performed by Anastasia Kokori and Georgia Pantelidou.

Please check this out!

In parallel, some educators and teachers have expressed their interest to perform a project with their students. To facilitate this effort, we decided to ask you- ExoClock observers- to provide some observing hours for one or more transits that could be provided to the school for a project. Last year, Yves Jongen has kindly offered a transit for an educational project led by Adrian Jones. You will still be the owners of the data; you just provide the opportunity for the students to choose the target and perform the analysis. Thank you in advance, this is a big inspiration and opportunity for students! Here you can express your interest to provide a transit: https://forms.gle/v3C3FFMADXpxSzLe8

1.6 Updates on campaigns

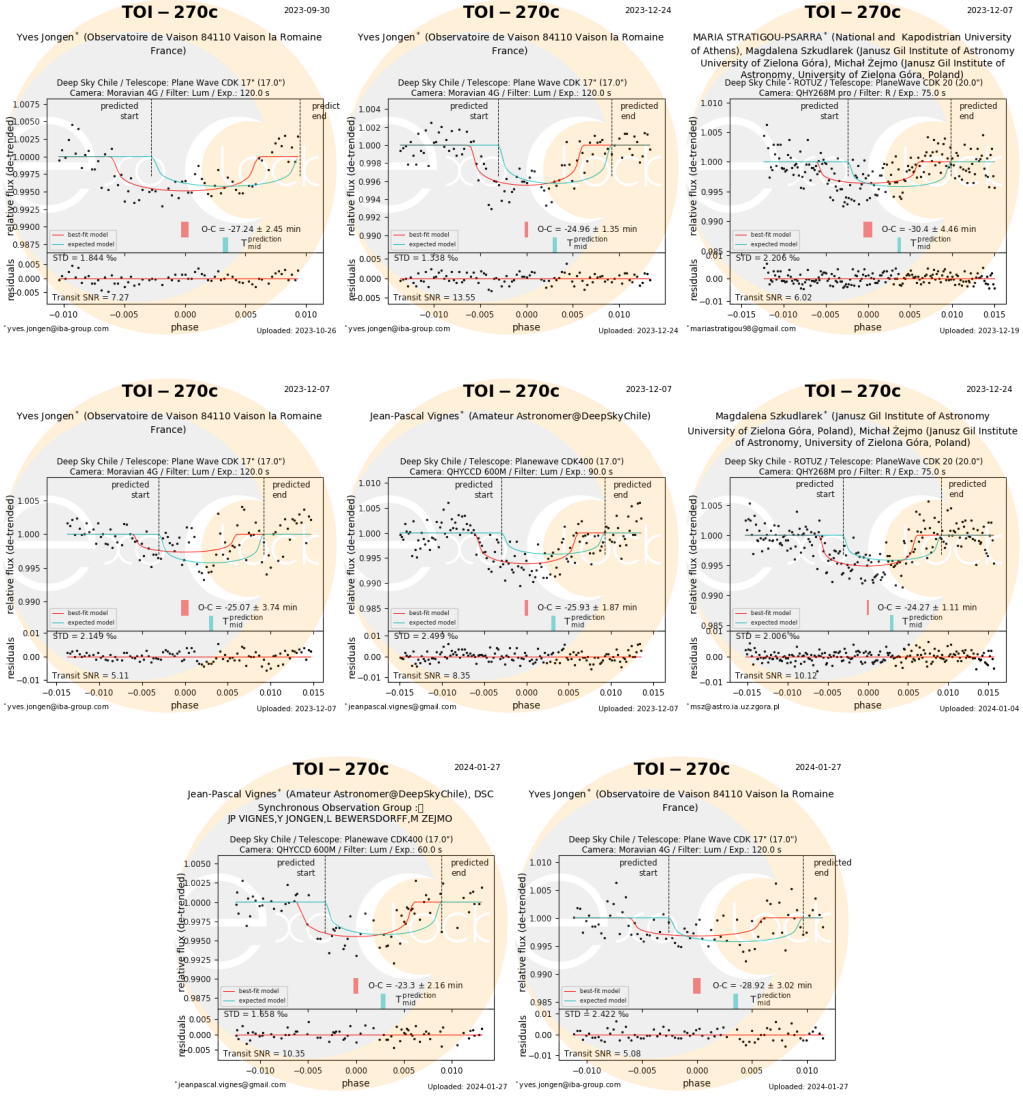
Recently we asked your participation in two campaigns that were organised by colleagues working on exoplanet research projects.

If you have observed either V1298 Tau or HD 110067 c and you haven't sent us the files yet, please contact us!

Thanks to those that joined! In March we will have another campaign for V1298 Tau, stay tuned!

2. Highlighted Observations

We would like to thank you all for the observations you contributed during the previous months! We have selected **TOI-270c**, an alert planet discovered by TESS. The target was initially observed by Yves Jongen in September 2023 where a time shift of 27 minutes was identified. Later, other ExoClock participants observed the planet and conformed the shift. Below you can see the observations by Jean-Pascal Vignes, Magdalena Szkudlarek, Maria Stratigou-Psarra and Yves Jongen.



Congratulations and thank you all for your observations!

3. “Exoplanet CV of CoRoT-3b”

As we mentioned in the previous newsletter, we started a new series of articles to enrich your background knowledge on the Ariel candidates. These articles feature one exoplanet each month and are written by our literature team. This month we are featuring **CoRoT-3b**, the article is attached in the next page. Enjoy!

Clear Skies,
the ExoClock team

“CV” of CoRoT-3b

by Alex Capildeo (The Open University, UK), ExoClock literature team member

Discovered in 2008 by Deleuil et al., CoRoT-3b is a remarkably massive transiting object, with a mass of 22 Jupiter Masses (Deleuil et al. 2008). It synchronously orbits its host star, the F-type CoRoT-3, with a period of 4.26 days and a semi-major axis of 0.06 AU. The orbit is almost circular. Due to its mass, CoRoT-3b is often referred to as a “super” Jupiter and there is much debate as to whether it is a failed star - a brown dwarf - or an exoplanet.

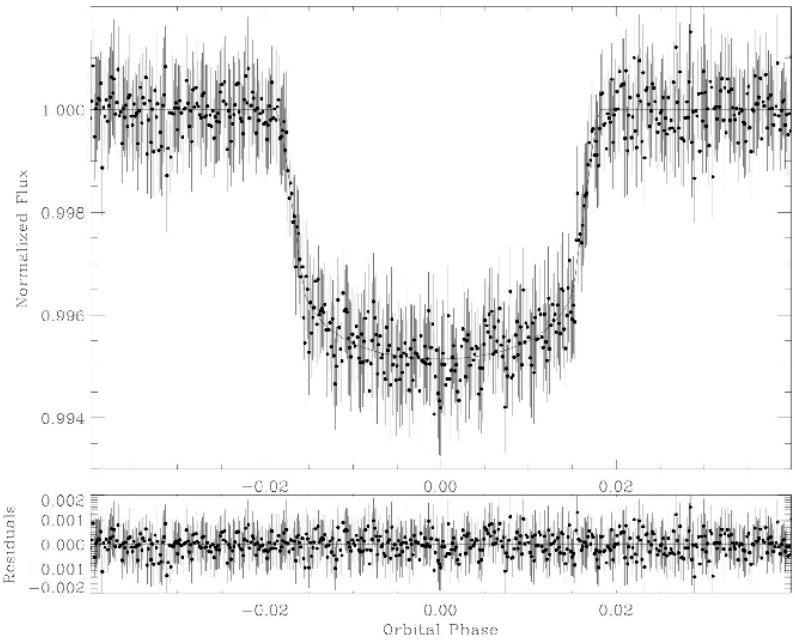


Figure 1: The transit light curve of CoRoT-3b from its discovery paper (Deleuil et al. 2008)

In order to distinguish brown dwarfs from exoplanets, there are two trains of thought. If the object is massive enough to fuse deuterium in its core, but not massive enough to sustain hydrogen fusion - and thus become a star - then it may be classified as a brown dwarf (Burrows et al. 1997). The second way is to base the category on the formation of the object. That is, if it can be shown that the object was formed by core accretion, then it is classed as an exoplanet (Mordasini et al. 2008). The gravitational collapsing of clouds is understood very well as the process that forms stars.

However, the fragmentation and subsequent collapse of molecular clouds can not only result in the formation of stars, but also substellar objects like brown dwarfs and exoplanets (Caballero et al. 2007). As a result of this common history, it is posited that brown dwarfs and exoplanets can overlap in mass. CoRoT-3b lies in this grey area (Leconte et al. 2009). The way it was formed remains unknown to this day, which explains the lack of clarity as to its true nature.

Ambiguities aside, CoRoT-3b exhibits several extreme features. Firstly, it has a dense convective envelope compared to its hot Jupiter peers (Wahl et al. 2021), which corresponds to a high surface gravity of around 50 times that of Earth. The close proximity to its host means CoRoT-3b is highly irradiated, and consequently hot with an effective surface temperature of 6740K (Deleuil et al 2008).

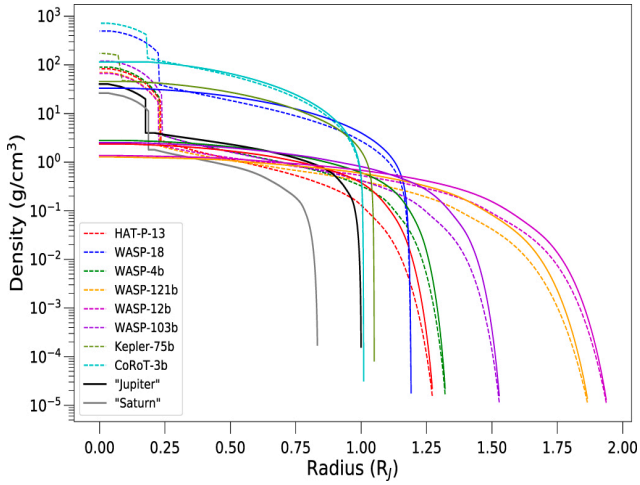


Figure 2: CoRoT-3b's higher density within its convective regions as compared to other hot Jupiters (Wahl et al. 2021).

The mysteries surrounding CoRoT-3b's formation and classification would certainly be helped by further research. It has been the subject of many papers and models, but few observations have been made beyond its discovery paper. Unfortunately, this is likely because a large 18.86" aperture is needed to observe this correspondingly large object in transit. ExoClock currently has no observations of this exoplanet in its database, therefore observations from a large instrument are needed to rectify this. This is perhaps something the upcoming Remote Observing Team can look into when controlling large aperture telescopes.

References:

[1]: Deleuil et al. 2008 (https://ui.adsabs.harvard.edu/abs/2008A%26A...491..889D/abstract)
[2]: Burrows et al. 1997 (https://ui.adsabs.harvard.edu/abs/1997ApJ...491..856B/abstract)
[3]: Cordasini et al. 2008 (https://ui.adsabs.harvard.edu/abs/2008ASPC..398..235M/abstract)
[4]: Caballero et al. 2007 (https://ui.adsabs.harvard.edu/abs/2007A%26A...470..903C/abstract)
[5]: Leconte et al. 2009 (https://ui.adsabs.harvard.edu/abs/2009A%26A...506..385L/abstract)
[6]: Wahl et al. 2021 (https://ui.adsabs.harvard.edu/abs/2021ApJ...921..105W/abstract)

NOTE: We remind you that you can find other exoplanet CVs in previous newsletters.