

A very important stellar occultation by a target of the JUICE space mission will be observable from Australia with modest equipment.

Kallichore is a “tiny” irregular satellite of Jupiter. This irregular satellite will very likely be visited by the ESA JUICE mission, and, as was the case for Arrokoth within the NASA New Horizons mission, the detection of stellar occultations is key for mission planning and for mission science. As many of you may also know well, the NASA Lucy mission has implemented an intensive occultation program for its targets. These occultation campaigns for NASA Lucy mission have had intensive amateur and citizen scientist involvement, with very nice scientific output and important public impact. See for instance this [NASA link](#) on one of the campaigns.

Given that retrograde irregular satellites such as Kallichore are thought to be Trans-Neptunian Objects (TNOs) captured during the dynamical instability phase of the Solar System, this is very interesting, as it would be the smallest TNO ever observed, and the potential science output is very high in our field. Juan L. Rizos (IAA-CSIC), with the help of the IAA-CSIC occultation team, had the initiative to observe an occultation by Kallichore to guarantee the JUICE visit, because the IAA-CSIC is involved in two of the ESA JUICE mission instruments. Juan L. Rizos has also been supported by the JUICE mission PI. Since JUICE’s main targets were the major satellites, there were no good plans for Kallichore. JUICE is now en route to Jupiter and would be able to visit Kallichore in October 2031.

In the end, a single-chord occultation was detected on 15 December 2025. Juan L. Rizos submitted a proposal to the Hubble Space Telescope (and other telescopes) that yielded high-quality images before the occultation, which were key for the success of the occultation campaign. Therefore, there was a substantial effort behind this success. We believe this is the smallest outer Solar System body whose occultation has ever been recorded, but the information obtained was limited because it came from just one observatory.

After the analysis of the occultation, we realized there were a few potential occultations by Kallichore soon after the first positive event, and it would be important to try to catch another one before the orbit solution degrades. Currently, the predictions are accurate thanks to the successful occultation, the HST data, and the 10 m GTC images that were obtained recently. It turns out that the best event of this year will take place in Australia on March 18th, at local time around 22:35 (12:35 UT) in a very convenient area (the path even reaches locations close to Sydney). The star is bright enough that large equipment is not strictly necessary (the star is $G = 13.5$ and the event will last around 1.1 s).

Therefore, we are seeking help to achieve a successful deployment. From past experience, we would prefer not to issue a broad, somewhat chaotic announcement to the amateur and professional astronomical community, but rather to organize a more targeted and effective campaign with fewer but more reliable participants using portable equipment or observatories located along the occultation path. And since many resources from publicly funded research projects have been involved, we need to ensure a proper scientific publication. We must therefore guarantee that the results do not leak before publication and that the observations are arranged in a highly coordinated way using the occultation portal for data management and campaign organization. We know that for some amateurs this may be difficult to understand, but these are the usual procedures in scientific collaborations

(unless projects are conceived and funded as fully open-science and citizen-science initiatives from the beginning, which is not the case here). Hence, if you involve third parties, they must know that they are required to follow the collaboration procedures. This is another reason to arrange a controlled campaign rather than issue a wide announcement. All observers will appear as co-authors in the scientific publication that will be produced if the campaign is successful. So please do not distribute this email widely, but only to collaborators willing to comply with our organizational methods. To see the shadow path and other details, you can follow this link: https://opop.obspm.fr/create_report/2901/

In summary, after the single-chord event we are pursuing a multichord one (we are trying to detect the occultation from at least three sites so that we can determine the size, shape, albedo, and position very accurately). If we succeed with a multichord event, the scientific outcome could be significantly improved and might lead to a very important paper before the actual flyby of Kallichore by JUICE in 2031 (and will help secure the flyby).

We are trying to coordinate this effort also with help from Dave Herald, Dave Gault, Hristo Pavlov and other very well trained and prestigious observers of stellar occultations in Australia.

Some general tips to observe this occultation:

- Make sure you synchronize your computer's clock accurately using the NTP protocol, or use a GPS-based camera if available (this is best).
- If your camera is a CCD and has long readout times between exposures, please try to reduce the readout time by using binning and/or windowing the chip, and use exposure times of around 2 s maximum. The event duration could reach 1.1 s at some sites, so integrations up to 2 s may still provide useful results.
- Note that inexpensive CMOS cameras have essentially no dead time during acquisition. Hence, if you can use a CMOS-based astronomical camera, that is recommended.
- The free software *SharpCap* for Windows usually handles timing very accurately and is a good tool for recording occultations with CMOS cameras or video. If possible, record the occultation as a FITS sequence. If not, the .ser format is also useful and the last preference goes to .avi
- Some good digital photographic cameras, such as the Sony Alpha 7 and others, have very sensitive sensors that can deliver useful images with practically no dead time between exposures, and they also work in video mode, which may be useful.
- From our simulations, telescopes of approximately 0.2 m in diameter or larger are needed. Smaller telescopes will not provide enough signal-to-noise ratio for integrations of up to 2 s.
- You can see this link to get some interesting background on the use of stellar occultations to support space mission here <https://lucy.swri.edu/occultations.html>