



## PRESS RELEASE

### A water world in another planetary system?

*An international team led by the Center for Astrobiology (CAB, CSIC-INTA) has studied in detail the LHS1140 planetary system. The results confirm the existence of two planets and suggest the presence of two more. One of the planets, LHS1140 b, located in the habitable zone, appears to have a large ocean of liquid water, making it an ideal target to search for biomarkers.*

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LHS1140 is a planetary system located in the constellation of Cetus, about 41 light years from Earth, in which two planets were already known, LHS1140 b and LHS1140 c, the first of them located in the so-called habitable zone of its star, a red dwarf five times smaller than our Sun. The closest planet, LHS1140 c, orbits the star every 3.8 days, while LHS1140 b does so every 24.7 days.

This study, led by researchers from the Center for Astrobiology (CAB, CSIC-INTA) and published in the journal *Astronomy & Astrophysics*, has been carried out using the data obtained with the state-of-the-art instrument ESPRESSO, installed in the Very Large Telescope of the European Southern Observatory in Chile, and with the NASA's space-based observatory TESS. The data have served to obtain very precise values of the masses and radii of both planets (6.5 Earth masses and 1.7 Earth radii for LHS1140 b; and 1.8 Earth masses and 1.3 Earth radii for LHS1140 c) allowing the authors to calculate not only their density (exactly the same as that of the Earth on both planets), but also characterize their internal composition (that is, the distribution of the core, mantle and crust of the planets, as well as the amount of liquid water they can have). In the case of LHS1140 b, the calculations point to a surface covered by an ocean of liquid water. Jorge Lillo-Box, CAB researcher and lead author of the study, points out that "it is the habitable zone planet where the potential amount of liquid water present has been more precisely quantified, which makes LHS1140 b one of the best planets to the search for biomarkers".

The high precision of the data has also allowed the researchers to find another potential planet in the system, LHS1140 d, with a mass of 4.8 Earth masses and an orbital period of 78.9 days. This planet is located slightly further from the star's habitable zone and has a composition on the frontier between rocky and gaseous. Finally, and as part of the TROY project ([www.troy-project.com](http://www.troy-project.com)) a detailed study of the data was carried out in search for co-orbital or exotrojan companions, this is planets sharing the same orbital path. The study suggests that the innermost planet (LHS1140 c) could have one of these co-orbital partners. It is one of the first exotrojan candidates discovered so far, but more detailed study and additional observations are needed to confirm this exotic scenario.



“The LHS1140 planetary system is ideal on our path towards atmospheric characterization of rocky planets. The innermost planet must have a high content of water vapor, while the planet in the habitable zone must show very different atmospheric characteristics and perhaps allow the search for biomarkers such as ozone or methane”, says Lillo-Box.

The LHS1140 planetary system contains the type of planets that the KOBE experiment will look for, a legacy program of the Calar Alto Observatory (CAHA) of which Lillo-Box is the Principal Investigator, and that will search for planets in the habitable zone of stars slightly hotter than LHS1140, although cooler than our Sun. These stars offer a unique opportunity to search for life because, although their activity is much less than in colder stars, their zone of habitability is closer than in the solar-type stars. The program, which will begin in 2021 and end in 2023, will use the CARMENES instrument installed on the CAHA's 3.5-meter telescope.

For David Barrado Navascués, CAB researcher and co-author of the study, “the LHS1140 planetary system should be a Rosetta stone for exoplanetary atmospheric studies. In this sense, the new James Webb Space Telescope, scheduled to launch in 2021, will play a fundamental role in these future studies, due to its size and instrumentation. Specifically, the Mid InfraRed Instrument (MIRI), developed by a European consortium in which the National Institute of Aerospace Technology (INTA) has a relevant participation, will be key to achieving this objective”.

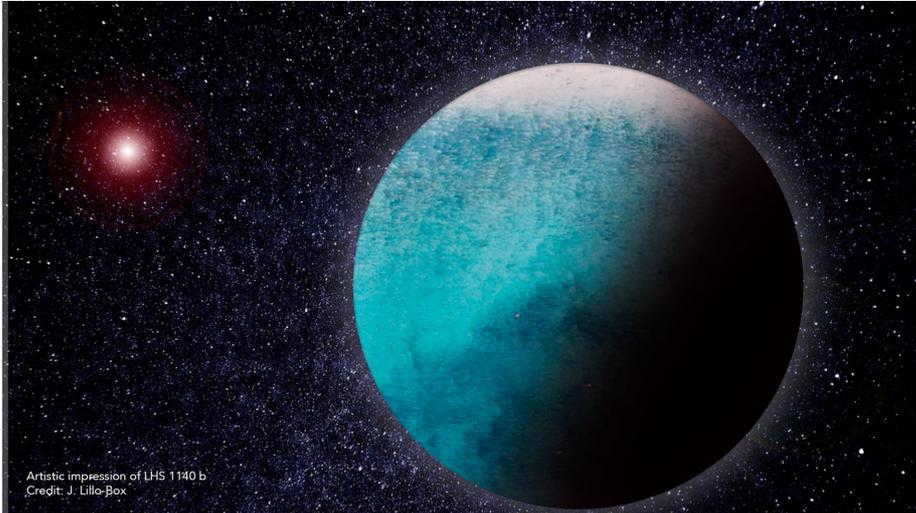
## **About CAB**

The Center for Astrobiology (CAB) is a joint research center of the CSIC and the INTA. Created in 1999, it was the world's first center specifically dedicated to astrobiological research and the first non-US center associated with the NASA Astrobiology Institute (NAI). It is a multidisciplinary center whose main objective is to study the origin, presence and influence of life in the universe. The Center for Astrobiology was distinguished in 2017 by the Ministry of Science and Innovation as the María de Maeztu Unit of Excellence, for the period July 1, 2018 to June 30, 2022.

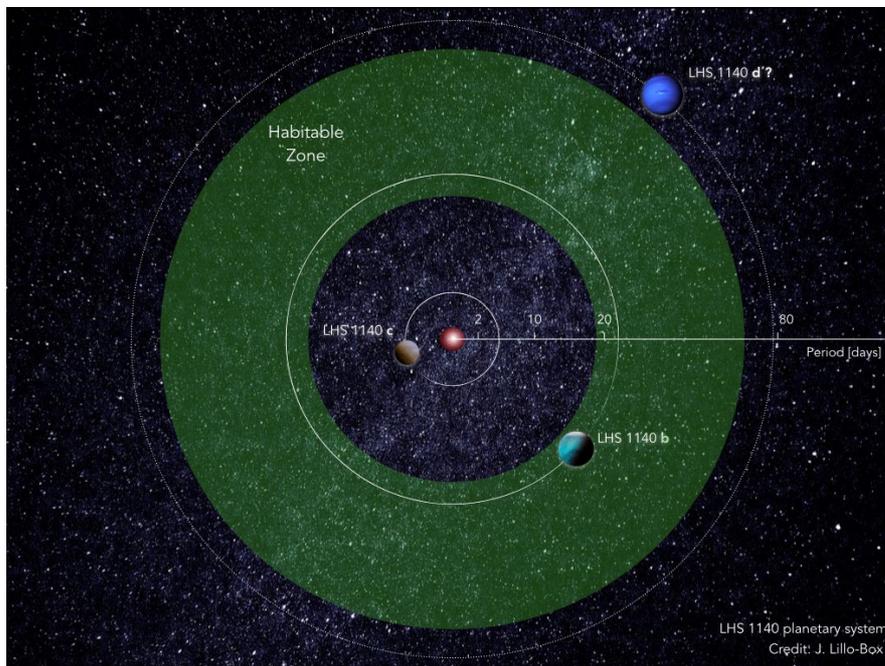
At the CAB, the REMS and TWINS instruments have been developed, (on Mars since 2012 and 2018 respectively); and MEDA and RLS, which will arrive in 2020. In addition, since its inception, the center has been working on the development of the SOLID instrument, aimed at the search for life in planetary exploration. It is also worth mentioning the participation of the Astrobiology Center in different missions and instruments of great astrobiological relevance, such as CARMENES, CHEOPS, PLATO, JWST or BepiColombo.



## More information



**Figure 1.** Artistic illustration of the planet LHS 1140 b and its parent star. Credit: J. Lillo-Box.



**Figure 2.** Schematic representation of the planetary system LHS 1140 with the two already confirmed planets LHS 1140 b and LHS 1140 c, and the planet candidate LHS 1140 d. Credit: J. Lillo-Box.



CENTRO DE ASTROBIOLOGÍA · CAB  
ASOCIADO AL NASA ASTROBIOLOGY PROGRAM



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**“The LHS 1140 planetary system revisited by ESPRESSO and TESS”**, by J. Lillo-Box, P. Figueira, A. Leleu, L. Acuña, J.P. Faria, N. Hara, N.C. Santos, A.C.M. Correia, P. Robutel, M. Deleuil, D. Barrado, S. Sousa, X. Bonfils, O. Mousis, J.M. Almenara, N. Astudillo-Defru, E. Marcq, S. Udry, C. Lovis and F. Pepe.

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