New year's mission to start new phase of exoplanet research

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Concordia base with the 40cm diameter ASTEP telescope in the foreground. Above the skies are lit by the Southern Lights, delicately drawing the type of the data the telescope obtains when a planet passes in front of its host star, producing a transit. Credit: Amanda Smith, University of Birmingham

A mission to one of the coldest and most remote places on earth will enable a new phase in the search for distant planetary systems.

University of Birmingham Ph.D. researcher Georgina Dransfield has traveled to the Franco-Italian Concordia Research Station in Antarctica,

to oversee the installation of a new state-of-the-art camera at the ASTEP (Antarctic Search for Transiting ExoPlanets) telescope.

The new instrument will enable scientists to see a much wider range of planets orbiting suns outside the Solar system, broadening our search for planets capable of hosting life.

The ASTEP telescope detects signals from distant planetary systems using the 'transit' method, measuring the slight dips in brightness that occur when a planet passes between Earth and its host star.

Purchased with support from the Science and Technology Facilities Council and from the European Research Council, the telescope's new camera is sensitive to the reddest wavelengths in the spectrum. This means it can spot the smallest stars in our galaxy, which are colder, fainter and therefore redder.

"It is easier to detect smaller planets orbiting these small stars, so we have a good chance of being able to detect planets of a similar size and temperature to the Earth, thanks to this new camera," explained Georgina.

The camera also has a 'blue' channel, so can see in two colors at once. This will enable astronomers to distinguish planetary signals from parasitic signals produced by other astrophysical phenomena, enabling new planets to be confirmed more rapidly and efficiently.

The University of Birmingham is the only university in the UK with access to an optical telescope in Antarctica. In winter, temperatures at Concordia regularly reach down to -80 degrees Celsius. This extreme cold strips the atmosphere of all moisture and reduces the ambient pressure, making Concordia 10 times drier than the driest desert, the Atacama desert in Chile, and the pressure is equivalent to being at

altitudes above 4,000 m. All these conditions are important for getting the best performance from the telescope.

In addition, the total absence of light pollution and the near permanent winter night between mid-May and mid-July enable the team to carry out observations almost continually, capturing rare planetary signals that would otherwise be extremely difficult to collect data on. This makes the site one of the most interesting and productive places in the world to conduct astronomical observations.

Amaury Triaud, Professor of Exoplanetology at the University of Birmingham, said: "Antarctica is a remarkable place from which to explore space. We have already collected a rich seam of data from observations made throughout the 2020 and 2021 season, which have included a number of important detections, including a temperate Neptune-sized planet, and a planetary system still in its adolescence. With this new camera in place in time for the 2022 observing season we are excited by the discoveries yet to be made."

More information: Jennifer A. Burt et al, TOI-1231 b: A Temperate, Neptune-sized Planet Transiting the Nearby M3 Dwarf NLTT 24399, *The Astronomical Journal* (2021). DOI: 10.3847/1538-3881/ac0432

L. G. Bouma et al, Cluster Difference Imaging Photometric Survey. II. TOI 837: A Young Validated Planet in IC 2602, *The Astronomical Journal* (2020). DOI: 10.3847/1538-3881/abb9ab

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