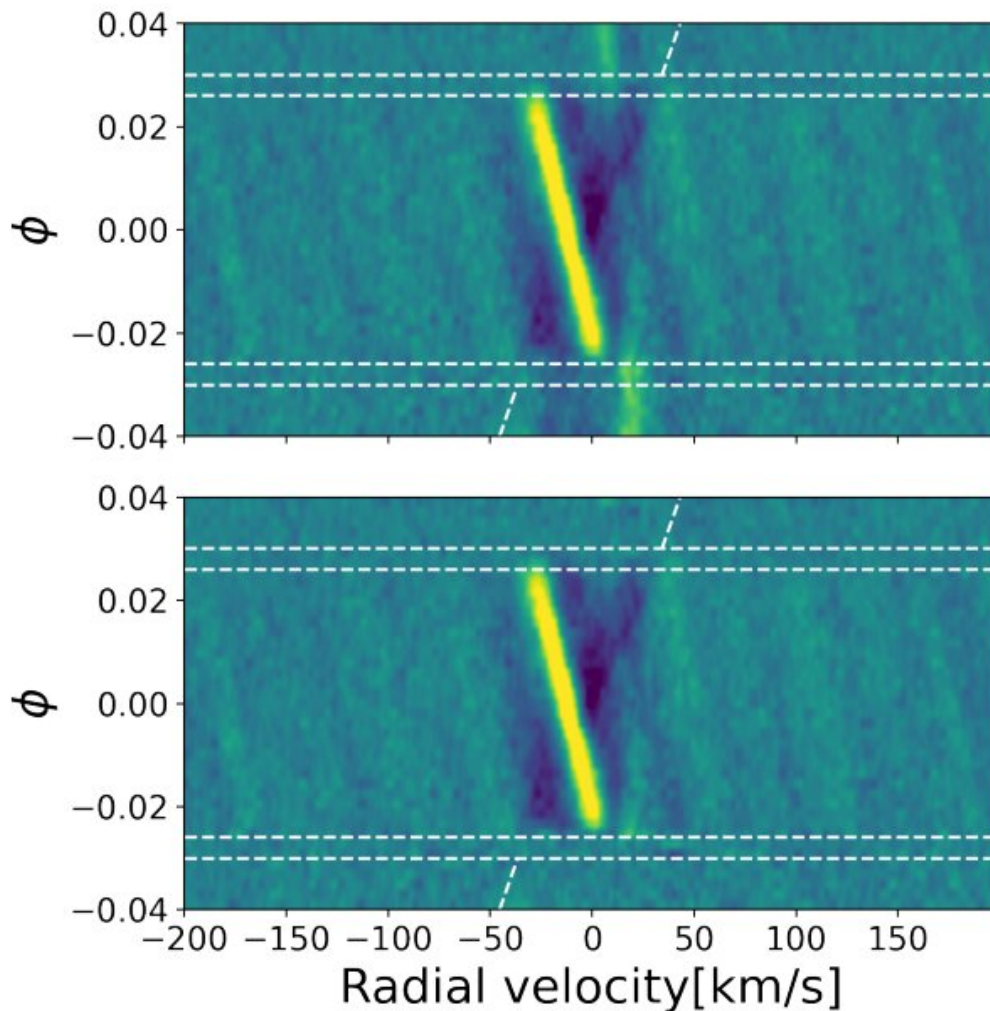


Chinese astronomers detect rubidium and samarium in the atmosphere of a distant exoplanet

April 20 2023, by Tomasz Nowakowski



MASCARA-4b: The combined cross-correlation function (CCF) map at

different orbital phase before (top panel) and after (bottom panel) the correction of stellar pulsation, respectively. Credit: Jiang et al, 2023

Using the Echelle SPectrograph for Rocky Exoplanets and Stable Spectroscopic Observations (ESPRESSO), astronomers from the Chinese Academy of Sciences (CAS) have investigated the atmosphere of MASCARA-4b—a distant "ultra-hot Jupiter" exoplanet. The study, published April 11 on the *arXiv* pre-print server, resulted in the detection of rubidium and samarium in an exoplanet's atmosphere for the first time.

At a distance of some 556 [light years](#) away from the Earth, MASCARA-4b is a gas giant with an equilibrium temperature of 2,250 K orbiting a bright A-type star. Its size is about 1.51 Jupiter radii and its mass is 1.67 Jupiter masses, which gives a density at a level of 0.48 g/cm³. The planet orbits its host every 2.82 days, at a distance of 0.047 AU from it. Due to its large atmospheric scale heights and transmission spectroscopy metric (TSM), MASCARA-4b is an excellent target for atmospheric characterization.

That is why a team of astronomers led by Zewen Jiang of the CAS Key Laboratory of Optical Astronomy in Beijing, China, decided to observe MASCARA-4b with ESPRESSO—a fiber-fed ultra-stable echelle high-resolution spectrograph, mounted on the Very Large Telescope (VLT) at European Southern Observatory (ESO) in Cerro Paranal, Chile.

"Two transits of MASCARA-4 b were observed on February 13, 2020 and March 1, 2020 with ESPRESSO under the ESO programs 0104.C-0605 (PI:WYTENBACH).... In this letter, we present a survey of atoms/ions in the [atmosphere](#) of the MASCARA-4b, using the two VLT/ESPRESSO transits data," the researchers wrote.

The observations detected several heavier species in the atmosphere of MASCARA-4 b, including rubidium (Rb), samarium (Sm), as well as ions of titanium (Ti^+) and barium (Ba^+). This is the first time when Rb and Sm are detected in the atmosphere of an exoplanet, while Ti^+ and Ba^+ were reported in several other [extrasolar planets](#).

Given that the new observations mark the third time when Ba^+ is detected in the atmosphere of an ultra-hot Jupiter (UHJ) [exoplanet](#), Jiang's team suspects that this element may be commonly present among the population of UHJs. The researchers added that the identification of Ba^+ in [high altitudes](#) in UHJ's suggests that such planets may experience atmospheric dynamics that we currently do not expect.

It was noted that Sm, with an atom number of 62, is so far the heaviest element found in the atmosphere of an alien world. It is also the first lanthanide series element that has been detected in exoplanets.

Besides the new discoveries, the study also confirmed previous detections of magnesium (Mg), calcium (Ca), chromium (Cr) and iron (Fe) in the atmosphere of MASCARA-4b. The authors of the paper encourage further atmospheric studies of exoplanets in order to find other rare elements.

"Higher precision HRS [high-resolution spectroscopic] studies should be further conducted on UHJs to reveal the presence of additional species and even some relatively abundant minor isotopes," the researchers concluded.

More information: Zewen Jiang et al, Detection of rubidium and samarium in the atmosphere of the ultra-hot Jupiter MASCARA-4b, *arXiv* (2023). [DOI: 10.48550/arxiv.2304.04948](https://doi.org/10.48550/arxiv.2304.04948)

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