

Media release, October 15, 2020

Two planets around a red dwarf

The “SAINT-EX” Observatory, led by scientists from the National Centre of Competence in Research NCCR PlanetS of the University of Bern and the University of Geneva, has detected two exoplanets orbiting the star TOI-1266. The Mexico-based telescope thus demonstrates its high precision and takes an important step in the quest of finding potentially habitable worlds.

Red dwarfs are the coolest kind of star. As such, they potentially allow liquid water to exist on planets that are quite close to them. In the search for habitable worlds beyond the borders of our solar system, this is a big advantage: the distance between an exoplanet and its star is a crucial factor for its detection. The closer the two are, the higher the chance that astronomers can detect the planet from Earth.

“But these stars are rather small and emit little light compared to most other stars, such as our Sun”, Brice-Olivier Demory, lead author of the study and Professor of Astrophysics at the University of Bern explains. These factors make them challenging to observe in detail. Without the proper instruments, any planets that might orbit them could easily be overlooked – especially terrestrial planets, like Earth, that are comparably small.

A dedicated telescope

One instrument, with which it is possible to study red dwarfs and their planets closely, is the Mexico-based SAINT-EX telescope, co-operated by the NCCR PlanetS. SAINT-EX is an acronym that stands for Search And characterisation of Transiting EXoplanets. The project has been named in honor of Antoine de Saint-Exupéry (Saint-Ex), the famous writer, poet and aviator. The SAINT-EX Observatory is a fully robotic facility hosting a 1-metre telescope. It is equipped with instrumentation specifically suited to enable high-precision detection of small planets orbiting cool stars.

Now, this specialization pays off: earlier this year, the telescope was able to detect two exoplanets orbiting the star TOI-1266, located around 120 light years from Earth. The research, published recently in the journal *Astronomy and Astrophysics*, provides a first impression of their characteristics.

A peculiar pair

Compared to the planets in our solar system, TOI-1266 b and c are much closer to their star – it takes them only 11 and 19 days respectively to orbit it. However, as their host star is much cooler than the Sun, their temperatures are not very extreme: the outer planet has approximately the temperature of Venus (although it is 7 times closer to its star than Venus is to the Sun).

The two planets are of similar density, possibly corresponding to a composition of about a half of rocky and metallic material and half water. This makes them about half as rocky as Earth or Venus but also far rockier than Uranus or Neptune.

In size, the planets clearly differ from each other. The inner planet, TOI-1266 b, measures up to a little under two-and-a-half times the Earth's diameter. This makes it a so-called "sub-Neptune".

The outer planet, TOI-1266 c, is just over one-and-a-half times the size of our planet. Thus, it belongs to the category of "super-Earths".

This places the two planets at the edges of the so-called radius-valley, as Brice-Olivier Demory explains: "Planets between about the radius of TOI-1266 b and c are quite rare, likely because of the effect of strong irradiation from the star, which can erode their atmospheres". Yilen Gómez Maqueo Chew, SAINT-EX Project Coordinator and researcher at the National Autonomous University of Mexico adds: "Being able to study two different types of planets in the same system is a great opportunity to better understand how these different sized planets come to be".

Good timing and help from the embassy

Having this opportunity, especially this year, is anything but a given. The scientists were fortunate enough to be able to complete their observations shortly before the Covid-19-related lockdown in Mexico. Shortly after the observations were made, the observatory had to be closed due to the consequences of the pandemic. This has not changed until today. The scientists hope to resume operations of SAINT-EX in the next few months and to target the next red dwarf and its potential planets. "Also, the Mexican Embassy in Bern was a great help in facilitating the discussions with the Mexican government and in providing continued support to the project", says Demory.

Publication Details:

Brice-Olivier Demory et al.: A super-Earth and a sub-Neptune orbiting the bright, quiet M3 dwarf TOI-1266, *Astronomy & Astrophysics*, Volume 642, 2 October 2020.

<https://doi.org/10.1051/0004-6361/202038616>

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Please see the following pages for more information.

SAINT-EX – Search and characterisation of exoplanets

SAINT-EX is an international collaboration which had its kick-off meeting in the National Astronomical Observatory in San Pedro Martir (MEX) in September of 2016. The project's principal investigator is Prof. Brice-Olivier Demory, from the Center for Space and Habitability of the University of Bern in Switzerland and National Center of Competence in Research PlanetS; the project's coordinator and leader in Mexico is Dr. Yilen Gomez Maqueo Chew from the Instituto de Astronomía of the Universidad Nacional Autónoma de México (UNAM). Also, part of the project are Prof. Willy Benz from the National Center of Competence in Research PlanetS, Prof. François Bouchy from the University of Geneva in Switzerland, Dr. Michaël Gillon from the University of Liège in Belgium, Prof. Kevin Heng from the University of Bern in Switzerland, Prof. Didier Queloz from the University of Geneva, Switzerland, and Cambridge in the UK, and Dr. Laurence Sabin, also from Instituto de Astronomía de Astronomía in UNAM. SAINT-EX has been funded by the Swiss National Science Foundation and the Universities of Bern, Geneva, Liège and Cambridge as well as UNAM. SAINT-EX also received support from the National Council for Science and Technology (CONACYT) through the National Laboratories call for proposals for the National Astronomical Observatory of San Pedro Martir.

[Project Website of the University of Bern](#)

Bernese space exploration: With the world's elite since the first moon landing

When the second man, "Buzz" Aldrin, stepped out of the lunar module on July 21, 1969, the first task he did was to set up the Bernese Solar Wind Composition experiment (SWC) also known as the "solar wind sail" by planting it in the ground of the moon, even before the American flag. This experiment, which was planned and the results analysed by Prof. Dr. Johannes Geiss and his team from the Physics Institute of the University of Bern, was the first great highlight in the history of Bernese space exploration.

Ever since Bernese space exploration has been among the world's elite. The numbers are impressive: 25 times were instruments flown into the upper atmosphere and ionosphere using rockets (1967-1993), 9 times into the stratosphere with balloon flights (1991-2008), over 30 instruments were flown on space probes, and with CHEOPS the University of Bern shares responsibility with ESA for a whole mission.

The successful work of the [Department of Space Research and Planetary Sciences \(WP\)](#) from the Physics Institute of the University of Bern was consolidated by the foundation of a university competence center, the [Center for Space and Habitability \(CSH\)](#). The Swiss National Fund also awarded the University of Bern the [National Center of Competence in Research \(NCCR\) PlanetS](#), which it manages together with the University of Geneva.