

Three elder sisters of the Sun with planets

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Prof. Niedzielski's team have been working on this subject for years. Thanks to precise observations of the sky, they have managed to discover 26 stars around which planets revolve. Credit: Andrzej Romanski/NCU

An international team led by Prof. Dr. habil. Andrzej Niedzielski, an astronomer from the Nicolaus Copernicus University in Torun (Poland), has discovered yet another three extrasolar planets. These planets revolve around the stars that can be called elder sisters of our Sun.

You can read about the astronomers' success in *Astronomy and Astrophysics*. The prestigious European journal will publish the paper, "Tracking Advanced Planetary Systems (TAPAS) with HARPS-N. VII. Elder suns with low-mass companions." Apart from Prof. Andrzej Niedzielski from the NCU Institute of Astronomy, the team which worked on the discovery includes Prof. Dr. habil. Gracjan Maciejewski, also from the NCU Faculty of Physics, Astronomy and Informatics, Prof. Aleksander Wolszczan (Pennsylvania State University), Dr. Eva Villaver (University of Madrid) as well as Dr. Monika Adamów and Dr. Kacper Kowalik (both from the University of Illinois).

Discoverers of planets

Prof. Niedzielski's team have been working on this subject for years. Thanks to precise observations of the sky, they have managed to discover 26 stars around which [planets](#) revolve. These are usually planetary systems much older than ours. Their suns are mostly [red giants](#). An exception is the Solaris system and the Pirx, a star similar to the Sun (although slightly less massive and cooler) and its planet, discovered in 2009.

"The red giant is a star that has burnt out hydrogen in its interior as a result of nuclear reactions and is rebuilding its internal structure to ignite helium burning nuclear reactions," explains Prof. Niedzielski. "Such a star shrinks in its central part, where the temperature starts to rise. Its outer areas expand significantly and cool down. Initially a yellow star, like the Sun, becomes red and huge. Hence the name of this type of stars. These stars can reach a size comparable to that of Earth's orbit."

Sisters of the Sun

The astronomers looked at 122 stars. They carried out their observations

using the Hobby-Eberly Telescope (HET) at the McDonald Observatory, near Fort Davis, Texas, and the Italian National Galileo Telescope, which is located on the island of La Palma (Canary Islands) in Spain. They succeeded in discovering other [extrasolar planets](#) orbiting the stars which could be called the big sisters of our Sun.

"These stars are red giants. They have masses exactly the same as our star, but they are a few billion years older, much bigger and cooler," explains Prof. Niedzielski. "The planets that we have discovered are gas giants—without surfaces, similar to our Jupiter. They orbit far too close to their [stars](#) for conditions favorable for the origin of life to occur on them or in their vicinity."

Eldest sister: HD 4760

The star HD 4760 is an eighth magnitude object in Pisces constellation. It is 40 times larger and emits 850 times more light than the Sun, but because of its distance (about 1781 light years away from us) it is invisible to the naked eye, but it is already within reach of even small and amateur telescopes.

"A planet about 14 times more massive than Jupiter revolves around it. It is in an orbit similar in size to that of Earth around the Sun, at a distance of about 1.1 astronomical units. A year on this planet lasts 434 days," says Prof. Niedzielski.

The observations of the star that led to the discovery of the planet took 9 years. They were conducted first with the Hobby-Eberly telescope and the HRS spectrograph, then with the Galileo telescope and the Harps-N.

"The observations were so long because in the case of the search for planets near red giants it is necessary to study several periods of rotation of the star, which can reach hundreds of days," explains the astronomer

from Toruń. "The researchers must make sure that a planet is actually observed, and not a spot on the star's surface that pretends to be a planet.

Younger sisters: TYC 0434-04538-1 and HD 96992

The astronomers have recently discovered a planet orbiting the TYC 0434-04538-1, a star about 2032 light-years away from us, in the Serpens constellation. Although it shines almost 50 times more strongly than the Sun, it is also invisible to the naked eye. The reason is again the great distance—to see this object of tenth apparent magnitude, you already need a small telescope. This star is ten times bigger than the Sun, and it is surrounded by a planet six times more massive than Jupiter.

"Interestingly, this planet orbits quite close to its star, at a distance of 0.66 astronomical units. In our Solar System it would be located between the orbits of Venus and Earth," explains Prof. Niedzielski. "A year on this gas planet lasts only 193 days. Observations of this star with both telescopes lasted 10 years. The third of the Sun's elder sisters, the HD 96992, is closest to us—'only' 1305 light years away. It is a star of the ninth magnitude in the Great Bear."

"This star, seven times bigger and almost 30 times more energetic than the Sun, has a planet with a mass only slightly bigger than that of Jupiter, in an orbit of 1.24 astronomical units. A year on this planet lasts 514 days," says Prof. Niedzielski.

This star has been observed with the use of two telescopes by astronomers for the longest [time](#)—14 years.

More information: A.T. Niedzielski et al, Tracking Advanced Planetary Systems (TAPAS) with HARPS-N. VII. Elder suns with low-mass companions, *Astronomy & Astrophysics* (2021). [DOI: 10.1051/0004-6361/202037892](https://doi.org/10.1051/0004-6361/202037892)

Provided by Nicolaus Copernicus University in Torun

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