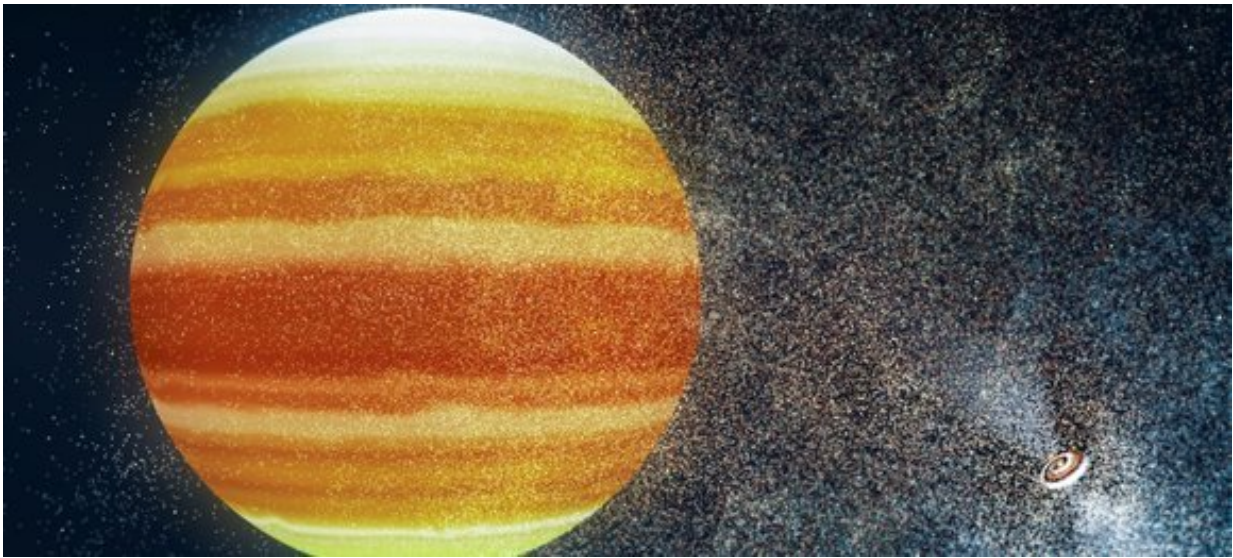


Habitable planets around pulsars theoretically possible

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Credit: Astronomie.nl

It is theoretically possible that habitable planets exist around pulsars. Such planets must have an enormous atmosphere that convert the deadly X-rays and high energy particles of the pulsar into heat. This is the conclusion of a paper by astronomers Alessandro Patruno and Mihkel Kama, working in the Netherlands and the United Kingdom. The paper appears today in the journal *Astronomy & Astrophysics*.

Pulsars are known for their extreme conditions. They are [neutron stars](#)

of only 10 to 30 kilometers in diameter. They have enormous magnetic fields, they accrete matter and they regularly burst out large amounts of X-rays and other energetic particles. Alessandro Patruno (Leiden University and ASTRON) and Mihkel Kama (Leiden University and Cambridge University) suggest that there could nonetheless be life in the vicinity of these stars.

It is the first time that astronomers have tried to calculate so-called habitable zones near neutron stars. The calculations show that the habitable zone around a neutron star can be as large as the distance from Earth to the sun. An important premise is that the planet must be a super-Earth with a mass between one and 10 times that of the Earth. A smaller planet will lose its atmosphere within a few thousand years. Furthermore, the atmosphere must be a million times as thick as that of the Earth. The conditions on the pulsar planet surface might resemble those of the deep sea.

The astronomers studied the pulsar PSR B1257+12 about 2300 light-years away in the constellation Virgo. They used the Chandra Space Telescope, which is specially made to observe X-rays. Three planets orbit the pulsar. Two of them are super-Earths with a mass of four to five times the Earth. The planets orbit close enough around the pulsar to warm up. Patruno says, "According to our calculations, the temperature of the planets might be suitable for the presence of liquid water on their surface. Though we don't know yet if the two super-Earths have the right, extremely dense atmosphere."

In the future, the astronomers would love to observe the pulsar in more detail and compare it with other pulsars. The ALMA telescope of the European Southern Observatory would be able to show dust discs around neutron stars. Such disks are good predictors of planets.

The Milky Way contains an estimated 1 billion [neutron stars](#), of which

about 200,000 are pulsars. So far, 3000 pulsars have been studied and only 5 pulsar [planets](#) have been found. PSR B1257+12 is a much-studied [pulsar](#). In 1992, the first exoplanets ever were discovered around this object.

More information: A. Patruno et al. Neutron star planets: Atmospheric processes and irradiation, *Astronomy & Astrophysics* (2017). [DOI: 10.1051/0004-6361/201731102](https://doi.org/10.1051/0004-6361/201731102)

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