Physicists discover new clue to planet formation

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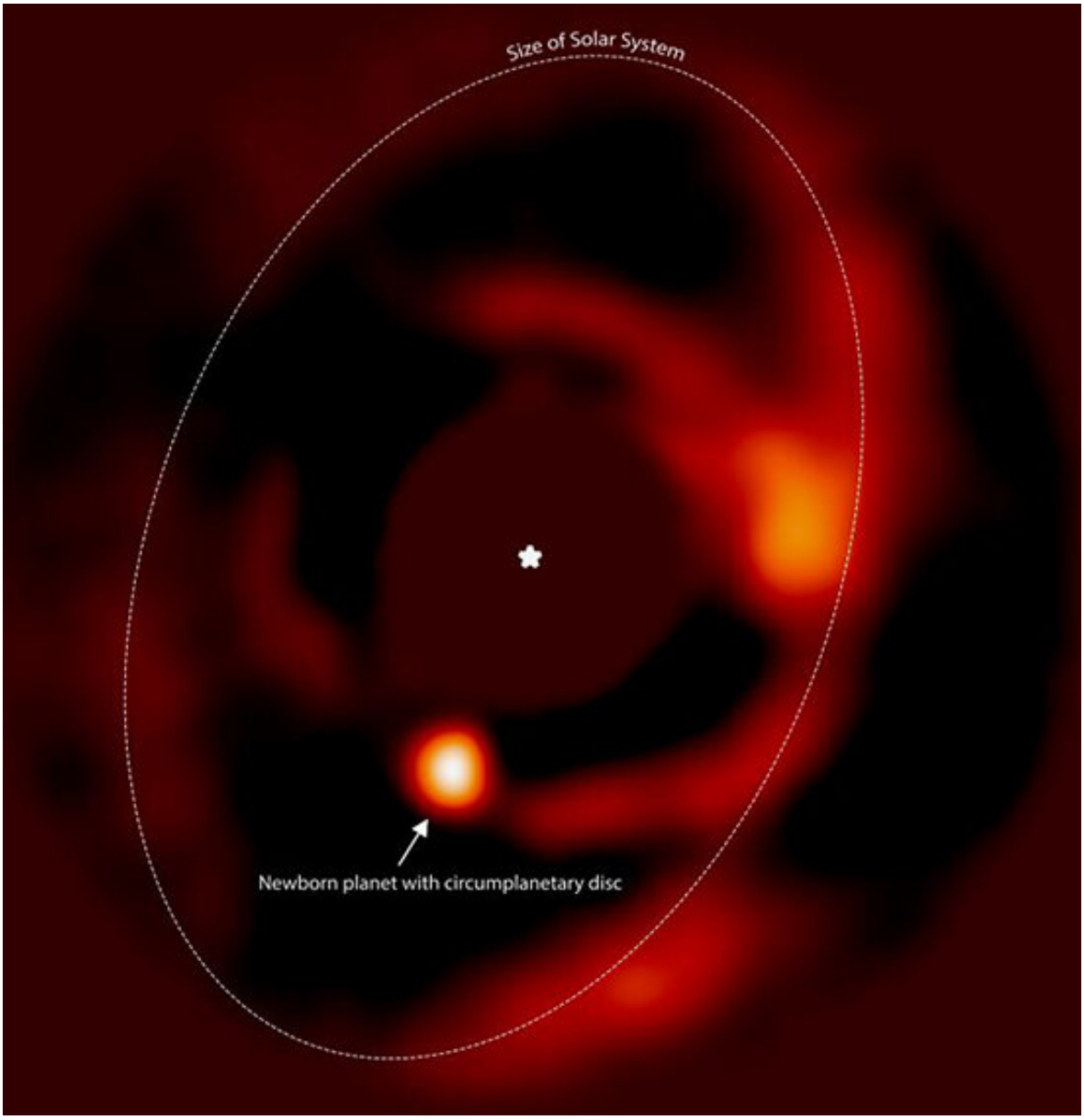

Infrared image of the newborn planet PDS 70 b and its circumplanetary disc,

within its birth environment. Size of the solar system given for comparison. Credit: V. Christiaens et al./ ESO.

An international study led by the Monash School of Physics and Astronomy has discovered the first observational evidence for the existence of circumplanetary discs.

The study published in the *Astrophysical Journal Letters* focused on young planets still in the process of formation (typically only a few million years old).

"Our research helps us to understand how our 4.6 billion year-old solar system came about, and how we got here," said lead study author Dr. Valentin Christiaens, a Postdoctoral Research Fellow in Astrophysics at Monash University.

The research team used the Very Large Telescope facility in Chile to obtain infrared images in different colors (wavelengths) of a newborn giant planet.

"We found the first evidence for a disc of gas and dust around it—known as a circumplanetary disc," said Dr. Christiaens.

"We think the large moons of Jupiter and other gas giants were born in such a disc, so our work helps to explain how planets in our solar system formed," he said.

Seeing the moons of Jupiter through a telescope had Galileo arrested in his day, because he saw that not everything orbited the Earth, and we were therefore not the centre of the Universe.

Dr. Christiaens said the method used to obtain the study results was innovative.

A newborn planet was much more difficult to observe than the star it orbited. The bright glare from the star had to be canceled from the images.

"The algorithm we developed could be used to extract faint signals from other complex datasets," Dr. Christiaens said.

The observed properties of these moons—and of other large moons of the gas giants have suggested that they formed within a circumplanetary disc.

This prediction has been supported by theoretical calculations and numerical simulations of increasing complexity over the past few decades.

"Despite an intensive search circumplanetary discs have until now eluded detection," Dr. Christiaens said.

"This first piece of evidence suggests theoretical models of giant planet formation are not far off."

"Our work adds another piece to the puzzle of giant planet formation, whose first piece was placed by Galileo four centuries ago with the discovery of the four major moons of Jupiter."

Study co-author Associate Professor Daniel Price also from the Monash School of Physics and Astronomy, and an ARC Fellow, said it is mind-blowing to think we can see planets in the process of formation, using the biggest telescope in the world.

"This result comes as the culmination of a long search for circumplanetary discs, through various means and at different wavelengths," said fellow Monash study author ARC Future Fellow Dr. Christophe Pinte.

More information: Valentin Christiaens et al. Evidence for a Circumplanetary Disk around Protoplanet PDS 70 b, *The Astrophysical Journal* (2019). DOI: 10.3847/2041-8213/ab212b. doi.org/10.3847/2041-8213/ab212b

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