Jupiter's 'Big Brother' Has Moon-Forming Dust Disk

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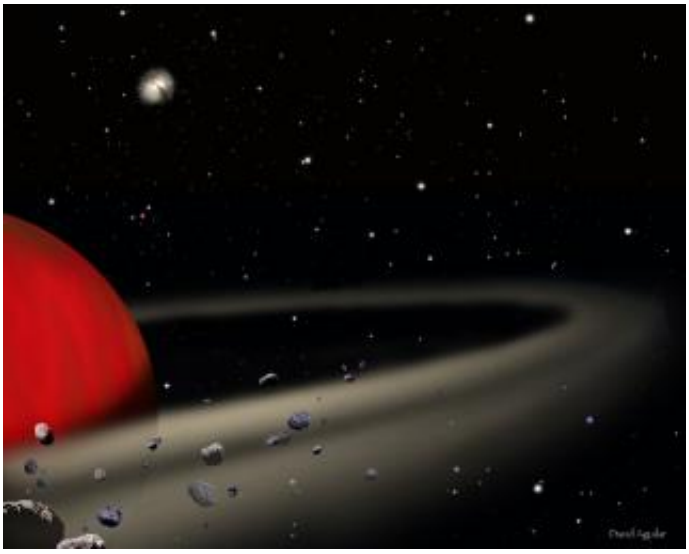

Astronomers have discovered a dusty disk around the 8-Jupiter-mass object called 2M1207B, shown here in an artist's conception. That disk eventually may form one or more moons like those orbiting the giant planets of our solar system. As seen from Earth, 2M1207B lies in the constellation Centaurus, which is also home to the peculiar galaxy NGC 5128 shown in the upper left of this image. Credit: David A. Aguilar (CfA)

Earth's Moon was created by an early collision with another large planetary body. It was a "chip off the old block." Mars captured its asteroidal moons as they passed by. But Jupiter made its own moons out of dust and gas remaining from its formation. Now, observations by astronomer Subhanjoy Mohanty of the Harvard-Smithsonian Center for

Astrophysics (CfA) and his colleagues provide the first direct evidence for a dusty disk around a distant planet that in mass would be Jupiter's "big brother."

"It is quite possible that moons or moonlets could form out of this disk, just as they have around the giant planets in our own solar system," said Mohanty.

Mohanty presented the discovery today in a press conference at the 208th meeting of the American Astronomical Society. Other members of the team are Ray Jayawardhana (University of Toronto), Nuria Huélamo (ESO) and Eric Mamajek (CfA).

The team studied a planetary mass object known as 2MASS1207-3932B, which is located about 170 light-years from Earth in the direction of the constellation Centaurus. 2M1207B, as it is abbreviated, orbits a tiny brown dwarf star at a separation of about 40 astronomical units, or 3.7 billion miles - comparable to the size of Pluto's orbit. That separation is much larger than typical for binary brown dwarf systems. The wide separation may indicate that the duo formed in relative isolation, far from passing stars that could have pulled them apart.

"This system probably won't survive for long. It won't last 5 billion years like our solar system has," said Mamajek. "All it would take is for a more massive interloper star to come along and yank the planet away from the brown dwarf."

Observations by Mohanty's team showed that the brown dwarf has a mass of about 25 Jupiters and a temperature of 4100 degrees Fahrenheit (2600 K). Its companion 2M1207B weighs about 8 times Jupiter and has a temperature of 2400 degrees F (1600 K). Both objects are warm due to their young age of 5-10 million years, having retained the heat of formation.

Given those temperatures, the team then calculated the expected brightness of both objects. The brown dwarf matched predictions but its companion was about 8 times fainter than expected. After examining several potential causes, the team concluded that the only plausible explanation was the presence of an edge-on dusty disk that blocked most of the planet's light. The planet is seen only in light scattered from the disk.

Spectral analysis shows that 2M1207B is a gas giant like Jupiter with no solid surface. As a result, it would be a poor abode for life. Any moons that might form around it, however, could prove more hospitable.

The large mass of 2M1207B relative to the brown dwarf star poses a puzzle for planetary formation theories. Typical planets like those in our solar system are less than one-hundredth the size of the central star. In contrast, 2M1207B holds one-third as much mass as the brown dwarf.

"Mass ratios of that size are more typical for binary stars than for planetary systems," said Mohanty. "2M1207B probably formed like a star, together with the brown dwarf, rather than from core accretion like giant planets around other stars."

Mohanty and his colleagues plan to study the polarization of light from 2M1207B in order to investigate the inclination of its disk as well as the size of dust grains within the disk. Further studies await the next generation of large telescopes, such as the Giant Magellan Telescope and the Atacama Large Millimeter Array, which may be able to directly detect the disk around the planetary mass companion.

Source: Harvard-Smithsonian Center for Astrophysics