One of the Most Massive Stars in our Galaxy Has a Hot Partner

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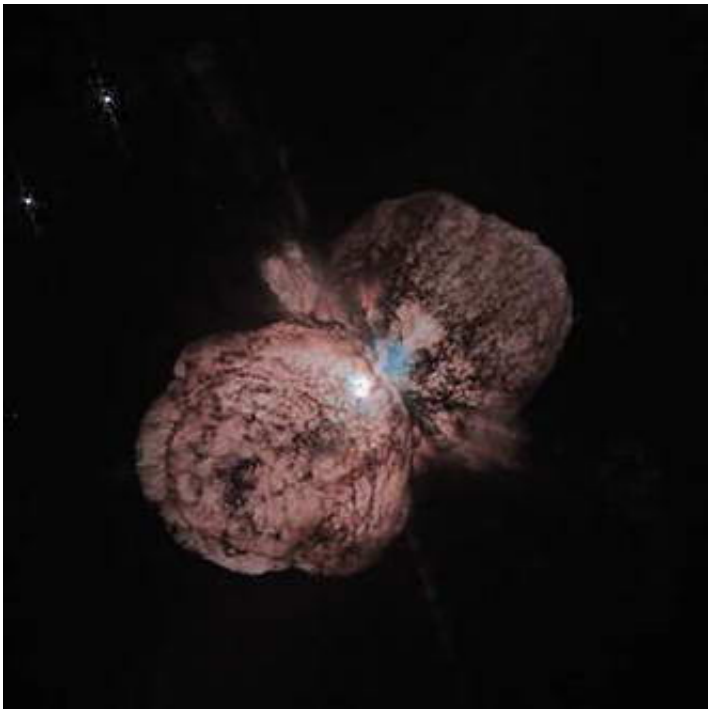

Scientists using NASA's Far Ultraviolet Spectroscopic Explorer satellite made the first direct detection of a companion star of Eta Carinae. Eta Carinae is one of the most massive and unusual stars in the Milky Way galaxy. The detection was made possible by the high temperature of the companion star and the unique sensitivity of the satellite at the shortest ultraviolet wavelengths.

Image: A huge billowing pair of gas and dust clouds is captured in this stunning Hubble telescope picture of the massive star, Eta Carinae. Credit: NASA and Jon Morse, University of Colorado

Eta Carinae is an unstable star thought to be rapidly approaching the final stage of its life. It is clearly visible from the southern hemisphere and has been the subject of intense studies for decades. This mysterious star is located about 7,500 light-years from Earth in the constellation Carina. Scientists thought a companion star in orbit around Eta Carinae might explain some of its strange properties, but researchers lacked direct evidence a companion star existed.

"Until now, Eta Carinae's partner has evaded direct detection," said Dr. Rosina Iping, a research scientist at Catholic University of America in Washington. "This discovery significantly advances our understanding of the enigmatic star."

Evidence that Eta Carinae might be a double star system was inferred from a repeating pattern of changes in visual, X-ray, radio and infrared light over approximately 5 ½ years. Astronomers thought a second star in a 5 ½ year orbit around Eta Carinae might cause the repeated changes in its light. The strongest indirect evidence supporting the double star theory is that once every 5 ½ years, the X-rays coming from the system disappear for about three months. Eta Carinae is too cool to generate X-rays, but it continuously blasts a flow of gas into space as a stellar wind at about 300 miles per second.

If its companion has a similar wind, their stellar winds would collide with enough force to generate the X-rays. This collision region must lie somewhere between the two stars.

As Eta Carinae moves in its orbit, it passes in front of the region where the winds collide, as viewed from Earth. When this occurs, Eta Carinae

eclipses the X-rays once every 5 ½ years, causing them to disappear. The last X-ray eclipse began on June 29, 2003. The 5 ½ year orbit places the companion star only about 10 times farther from Eta Carinae than Earth is from the sun. Eta Carinae is too far away for telescopes to distinguish two stars in such a close orbit.

Another way to find evidence of a double-star system would be to detect the light of the second star, which in this case is much fainter than Eta Carinae. Several scientists searched for light from Eta Carinae's companion using ground-based telescopes, but none succeeded. Because the companion is thought to be much hotter than Eta Carinae, astronomers reasoned it should be brighter at shorter wavelengths like ultraviolet light. However, it still escaped detection when it was searched for using the ultraviolet capabilities of the Hubble Space Telescope.

Iping and her collaborators used the satellite to detect the companion, because it can see even shorter ultraviolet wavelengths than Hubble. The team observed the far-ultraviolet light from Eta Carinae with the satellite on June 10, 17 and 27, 2003, right before the expected X-ray eclipse. While the far ultraviolet light from Eta Carinae was seen in the observations from June 10 and 17, it vanished on the 27, two days before the X-ray eclipse.

The disappearance of far ultraviolet light so close to the X-ray eclipse implies when Eta Carinae eclipsed the X-rays, it also eclipsed the companion star. The far-ultraviolet light observed prior to the eclipse was from the hotter companion, because Eta Carinae is too cool to emit much far-ultraviolet light.

"This far ultraviolet light comes directly from Eta Carinae's companion star, the first direct evidence that it exists," said Dr. George Sonneborn. He is Far Ultraviolet Spectroscopic Explorer Project Scientist at NASA's Goddard Space Flight Center, Greenbelt, Md. "The companion star is

much hotter than Eta Carinae, settling a long-standing mystery about this important star."

This discovery will be published today in the Astrophysical Journal Letters. Authors include Iping, Sonneborn and Ted Gull of Goddard; Derck Massa of SGT Inc., Greenbelt, Md.; and John Hiller of the University of Pittsburgh. The project is a NASA Explorer mission developed in cooperation with the French and Canadian space agencies by Johns Hopkins University, Baltimore, University of Colorado, Boulder, and University of California, Berkeley. Goddard manages the program for NASA's Science Mission Directorate.

Source: NASA