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Star Power

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An astronomy research team led by Columbia scientists has discovered that a spinning neutron star with a superpowerful magnetic field — called a magnetar — is emitting radio waves, behavior that has never been observed in magnetars.

“No one had ever found radio pulses coming from a magnetar,” said Fernando Camilo, associate research scientist at Columbia’s Astrophysics Laboratory, and the lead author of a paper that appeared in Nature in August. “This object is going to teach us new things about magnetar physics that we would never have learned otherwise.” The star, named XTE J1810-197, is approximately 10,000 light-years from Earth in the direction of the constellation Sagittarius and gives off powerful pulses of radio waves every 5.5 seconds. It acts much like a radio pulsar, a neutron star with far weaker magnetic fields. Camilo’s finding puts in question previous theories that magnetars were unlikely to emit radio waves, since their magnetic fields are up to 1000 times stronger than those of radio pulsars.

Neutron stars are the remnants of massive stars that have exploded as supernovas. Ordinary pulsars are neutron stars that emit “lighthouse-like beams” of radio waves along the poles of their magnetic fields. As the star spins, the beam of radio waves is flung around, and when it passes the direction of Earth, astronomers can detect it with radio telescopes.

Not only are the radio waves unusual, but unlike ordinary pulsars, which get dimmer at higher frequencies, XTE J1810-197 stays bright, and, according to Camilo, holds the record for the highest radio frequency at which a pulsar has been detected. He theorizes that the star’s intense magnetic field is twisting, causing changes in the locations where huge electric currents flow along the magnetic-field lines. Those currents likely generate the radio pulsations, whose characteristics change day by day.

Camilo’s team, comprising astronomers from Columbia, the US National Radio Astronomy Observatory, and the CSIRO Australia Telescope National Facility have

traveled around the world to observe the magnetar through telescopes in the US, Australia, Spain, and France. “We are doing this to understand broadly the evolution of stars,” says Camilo. “How they are born, live, and die in this galaxy.”



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All categories >