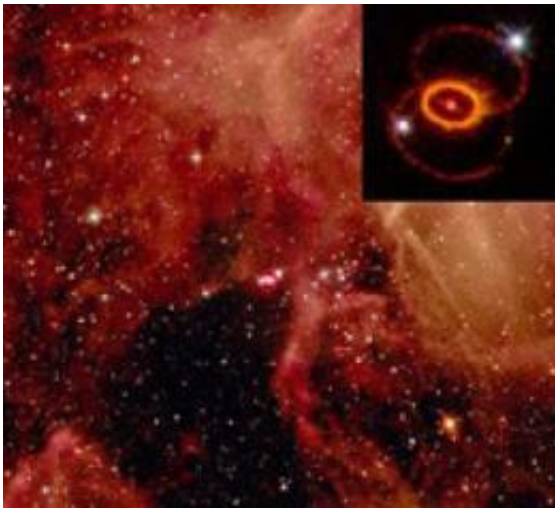


# Discovery of two types of neutron stars points to two different classes of supernovae

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This is a supernova star-field. Credit: Hubble Heritage Team (AURA/ STScI/ NASA)

Astronomers at the universities of Southampton and Oxford have found evidence that neutron stars, which are produced when massive stars explode as supernovae, actually come in two distinct varieties. Their finding also suggests that each variety is produced by a different kind of supernova event.

Neutron stars are the last stage in the evolution of many [massive stars](#). They represent the most extreme form of matter: the mass of a single neutron star exceeds that of the entire sun, but squeezed into a ball

whose diameter is smaller than that of London.

In a paper which will be published this week in *Nature*, Professors Christian Knigge and Malcolm Coe from the University of Southampton worked with Philipp Podsiadlowski of Oxford University to reveal how they have discovered two distinct populations of [neutron stars](#) that appear to have formed via two different supernova channels.

"Theoreticians have speculated before about the possible existence of different types of neutron stars, but there has never been any clear observational evidence that there is really more than one type," said Professor Coe.

The astronomers analysed data on a large sample of high-mass X-ray binaries, which are double star systems in which a fast-spinning neutron star orbits a massive young companion. The neutron star in these systems also periodically siphons off material from its partner. During such phases, the neutron star becomes an X-ray pulsar: its brightness increases tremendously, but the resulting X-ray radiation is pulsed on the neutron star spin period. Such systems are very useful, because by timing their pulses, astronomers can accurately measure the neutron star spin periods.

The astronomers detected two distinct groupings in a large set of spin periods measured in this way, with one group of neutron stars typically spinning once every 10 seconds, and the other once every 5 minutes. This finding has led them to conclude that the two distinct neutron star populations formed via two different supernova channels.

"These findings take us back to the most fundamental processes of stellar evolution and lead us to question how [supernovae](#) actually work," Professor Knigge added. "This opens up numerous new research areas, both on the observational and theoretical fronts."

**More information:** 'Two Populations of X-ray Pulsars Produced by Two Types of Supernovae' *Nature* (2011).

Provided by University of Southampton

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