Are stellar explosions created equal?

August 22 2011

Cosmic distances are difficult to grasp and no less difficult to measure. When it comes to other galaxies or even remote parts of our own Milky Way, distance measurements are nothing but assessments, derived from indirect clues.

Highly important among such clues are supernovae, extremely luminous stellar explosions. The distance to a supernova of a particular type, called Type Ia, can be calculated from its brightness: the brighter it appears, the closer it is to the viewer. Thanks to such supernovae, for example, astronomers have famously revealed that our universe is expanding at an accelerated pace, which suggests that it's permeated with mysterious dark energy. These calculations, however, are based on the assumption that all Type Ia supernovae have the same luminosity. Are all these explosions indeed created equal?

Type Ia supernovae are thought to be born when an exceedingly dense star called a white dwarf receives more mass from a nearby star, until it's so 'overwhelmed' that it explodes. A new study reported in *Science* and led by Weizmann Institute researchers, has gained major insight into the nature of these mass 'donors.' The study was performed by Dr. Avishay Gal-Yam and postdoctoral fellow Dr. Assaf Sternberg of Weizmann's Particle Physics and Astrophysics Department, in collaboration with scientists from more than a dozen research centers in the United States, Europe and Australia.

The researchers have revealed that in about a quarter of the cases in spiral galaxies, and possibly more, the companion star that 'donates' its mass to the white dwarf is probably a regular, medium-sized star, largely similar to our own Sun. They reached this conclusion by analyzing the outflow of gas, typical of sun-like stars, observed during the 'donation' of the mass. These findings constitute a major step toward determining the nature of all stellar 'donors,' with the ultimate goal of establishing whether supernovae everywhere evolve in the same manner, having the same luminosity at various stages. Understanding their evolution, in turn, can greatly enhance our ability to measure distances throughout the cosmos and map its evolution and geometry.

Provided by Weizmann Institute of Science