

Researchers try new approach for simulating supernovas

Eurekaalert!

Two University of Texas at Arlington researchers want to bridge the gap between what is known about exploding stars and the remnants left behind thousands of years later. So they're trying something new - using SNSPH, a complex computer code developed at Los Alamos National Laboratory.

On Tuesday, Carola I. Ellinger, a post-doctoral researcher at UT Arlington, and Sangwook Park, an assistant professor in the College of Science's physics department, were scheduled to present their research on "3D Simulations of Supernovae into the Young Remnant Phase" at the national meeting of the American Astronomical Society in Long Beach, Calif. Their oral presentation focuses on first efforts to use SNSPH, a parallel 3-dimensional radiation hydrodynamics code written in 2005, to create 3D simulations of a core-collapse supernova evolving into remnants.

"There are a lot of numerical simulations for the explosion of the supernova and a lot of simulations of the blast wave expanding into interstellar medium, but there was no useful work connecting the two, even though the physics are connected," said Park. "Now, we are using the most appropriate program we know to do that."

Besides Ellinger and Park, co-authors of the abstract include: Gabriel Rockefeller and Chris Fryer, of the Computer, Computational, and Statistical Sciences division at Los Alamos National Laboratory; and Patrick Young, of the Arizona State University School of Earth and Space Exploration.

Core collapse supernovas make up nearly three-quarters of all supernovas and they are the type of star explosions that create black holes and neutron stars. Scientists study them to learn more about the history and landscape of the universe, including how minerals were distributed and planets formed. Typically, individual researchers focus on either the blast or the remnants.

Though their project is in its initial stages, the researchers hope their new models will help reveal the detailed nature of the two features of a supernova remnant - characteristics that arose in instabilities during the explosion and those that were created in the interaction with surrounding medium. Ellinger said she hopes the simulations will eventually be used to interpret X-ray data from NASA's Chandra space telescope as well as other missions, such as the Nuclear Spectroscopic Telescope Array, or NuSTAR, launched in 2012.

"Dr. Park and Dr. Ellinger are taking existing tools, looking at the rapidly expanding field of astronomy data and finding new ways to use the two together. This kind of creative thinking is a model for UT Arlington students and fellow scientists," said

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Published on Electronic Component News (<http://www.ecnmag.com>)

Pamela Jansma, dean of the UT Arlington College of Science.

The research team used resources at the Texas Advanced Computing Center at UT Austin for hydrodynamic calculations.

Park said the new work with SNSPH can be traced back to increases in data about the composition of supernova remnants, much of which has been brought about by the Chandra X-ray Observatory. Chandra, launched in 1999, is NASA's flagship mission for X-ray astronomy.

With increasingly detailed data, scientists studying supernova remnants in the Milky Way are now able to differentiate between debris that was ejected from the exploded star, also called the progenitor, and the pre-existing ambient material that was swept up in the blast wave. This gives researchers some of the parameters they need to trace the history of the remnant, according to Park and Ellinger.

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