

# Argonne, Notre Dame begin new nuclear theory initiative

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Physicists at the U.S. Department of Energy's Argonne National Laboratory and the University of Notre Dame have begun a new collaborative project to explore and explain the physics of rare nuclear isotopes.

The collaboration, "Advancing Nuclear Theory for a Rare Isotope Accelerator: Nuclear Structure and Reactions for Astrophysics," will include joint research efforts as well as exchanges of scientists, post-doctoral students, and graduate students during the three-year first phase of the program.

Rare nuclear isotopes are extremely short-lived and have not been found naturally since the beginnings of time. The cosmic processes that create the chemical elements, fuel the sun and stars and make life possible on Earth stem from these rare isotopes. The Department of Energy is proposing to build a Rare Isotope Accelerator, which would create these rare isotopes and help answer key scientific questions about the formation of the galaxies, stars and planets; Argonne is a candidate site for that facility.

The Argonne-Notre Dame collaboration will explore the role of rare nuclear isotopes in astrophysical phenomena, including supernovae, colliding neutron stars and nuclear processes, such as solar burning. Many of the nuclei that participated in the evolution of our galaxy have never been made on earth, and theories to describe them are not yet quantitatively reliable.

“Experimental and theoretical efforts in this direction represent great challenges and opportunities for nuclear science in coming years,” said Robert Rosner, director of Argonne National Laboratory.

The initiative will also provide positions for two new postdoctoral fellows, one at each site, support graduate training schools with hands-on research, support research symposia and workshops, and attract distinguished visiting scholars to Argonne and Notre Dame. The initiative will lay the foundation for nuclear theory inputs for specific astrophysical problems and refined theoretical methods that will be of use far into the future. It will strengthen the skills and knowledge base of both the nuclear physics and astrophysics communities and will expand the interaction between them.

The theory groups at Argonne and Notre Dame have complementary expertise in nuclear astrophysics and nuclear structure. Both sites also have strong experimental nuclear physics programs. “Consequently, in bringing Argonne and Notre Dame closer together, this initiative materially strengthens the capacity for growth and productivity in nuclear physics,” Rosner said.

Both Argonne and Notre Dame are members of the Joint Institute for Nuclear Astrophysics. The initiative's programs will be coordinated with those of this National Science Foundation Physics Frontier Center.

Source: Argonne National Laboratory

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