C+C Fusion reactions

Sergio Almaraz-Calderon
Physics Division, Argonne National Laboratory, USA

S. Almaraz-Calderon, P. F. F. Carnelli, K. E. Rehm, M. Albers, M. Alcorta, M. Avila, P. F. Bertone, B. Digiovine, H. Esbensen, J. O. Fernández Niello, D. Henderson, C. L. Jiang, J. Lai, S. T. Marley, O. Nusair, T. Palchan-Hazan, R. C. Pardo, M. Paul, D. Santiago-Gonzalez, and C. Ugalde.

Fusion reactions are essential in the production and study of exotic nuclei away from the valley of stability, as well as for understanding the energy production in stars. With the advent of radioactive beams, new frontiers for fusion reaction studies have become accessible since fusion reactions induced by halo nuclei could lead to a considerable increase in the fusion probability at low energies. Fusion reactions also play an important role in nuclear astrophysics. The $^{12}C+^{12}C$ fusion reaction is an important energy source during the late stages of stellar evolution and in stellar explosions such as type Ia supernovae and x-ray bursts. Fusion reactions among neutron-rich nuclei have been associated with the so called x-ray superbursts. These day-long flares that emit 1000 times more energy than normal x-ray bursts are thought to involve the unstable burning of carbon from the ashes of normal x-ray bursts and may provide an additional heat source which can affect the strongly temperature-dependent carbon burning. In this talk I will discuss our efforts at ANL to measure fusion reactions, in particular, our recent results measuring for the first time the total fusion cross sections in the systems $^{10,14,15}C+^{12}C$ using a newly developed, highly efficient, active target-detector system (MUSIC) designed to measure fusion excitation functions with radioactive beams.

This work is supported by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics, under contract number DE-AC02-06CH11357.