Future of Nuclear Data for Nuclear Astrophysics

Michael S. Smith

*Physics Division, Oak Ridge National Laboratory**

Nuclear astrophysics research addresses some of the most fundamental and compelling questions in nature: What are the origins of the elements that make up our world? How did the solar system, the sun, the stars, and the galaxy form, and how do they evolve? Measurements and theoretical descriptions of microscopic nuclear physics phenomena provide the foundation for sophisticated models of these macroscopic astrophysical systems. These models are increasingly challenged by observations from space- and ground-based instruments that provide an incredibly detailed view of the Cosmos. The ability of astrophysical models to explain these observations strongly depends, in many instances, on the input nuclear data, and the latest models require more extensive and precise sets of nuclear data than ever before. In fact, progress in solving numerous astrophysical puzzles hinges on the availability of accurate, comprehensive sets of nuclear data that incorporate the latest laboratory measurements and theoretical results. Studies in this field can potentially bring wide public exposure to nuclear data activities.

The production of nuclear datasets for astrophysics requires dedicated efforts in data compilation, evaluation, processing, and dissemination. Unfortunately, the manpower base for this work is eroding just as the rate of production of new results is increasing. Furthermore, the process of converting laboratory results into entries in a database is currently quite complicated and requires the use of numerous computer codes and multiple steps (and often numerous individuals). For these reasons, some vital nuclear datasets have not been updated for over a decade, and it is often the case that datasets are not freely shared within the community. The wealth of data expected from future facilities such as the Rare Isotope Accelerator (RIA) will only to exacerbate this problem. Unfortunately, there is currently neither sufficient manpower nor an identified mechanism to rectify this situation. To make the best use of investments in nuclear astrophysics measurements, it is imperative to take action now to: increase evaluation manpower, in both the nuclear data and nuclear astrophysics communities; improve communication between ongoing evaluation centers, and between evaluators and the astrophysics end users; streamline the process of converting lab measurements into rates; and more efficiently manage and visualize nuclear astrophysics datasets. Possible mechanisms to achieve each of these goals will be presented, along with a description of some ongoing activities in these directions.

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Email: msmith@mail.phy.ornl.gov