# Nuclear Data Strategies for Mapping the Cosmos

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**Abstract.**
Significant advances are being made in understanding the structure of nuclei, especially those far from stability. The information from many such studies is vital to solving some important puzzles in astrophysics, such as the origin of the elements and the evolution of stars. However, dedicated efforts in data compilation, evaluation, dissemination, and coordination are needed to ensure that the latest nuclear measurements and theoretical calculations can be effectively utilized for astrophysics studies. A number of nuclear data strategies for astrophysics are presented.

## NUCLEAR PHYSICS INFORMATION FOR COSMIC STUDIES

This conference featured many detailed descriptions of significant advances in understanding the underlying symmetries and behavior of nucleons in nuclei. Especially exciting are the efforts to probe nuclei far from stability - an area which represents a vital part of the future of the field of nuclear physics. Nuclear structure studies are important not only to understand the nature of the atomic nucleus, but also for "mapping the cosmos" - that is, for advances in astrophysics. For example, nuclei are produced via nuclear processes in astrophysical environments, so a knowledge of the structure of nuclei is needed to understand the cosmic origin of the elements. Furthermore, interactions between nuclei generate the energy we see as starlight and sunlight, and are responsible for changes in stellar composition and, therefore, for the evolution of stars. Measurements and theoretical descriptions of nuclei and their interactions, therefore, provide a foundation for sophisticated models of macroscopic astrophysical systems ranging from the Big Bang to exploding stars to the inner workings of our own Sun. In many instances, the ability of astrophysical models to accurately describe the latest, spectacular observations of the cosmos strongly depends on the input nuclear data. Thus, more extensive and precise nuclear data is required for advances in astrophysics.

It is not enough, however, to perform state-of-the-art nuclear measurements or theoretical calculations. To be utilized for astrophysical studies, this information has to be appropriately formatted for input into astrophysics simulation codes. This requires a *dedicated effort* in data compilation, evaluation, dissemination, and coordination. Currently, the results of many of the latest nuclear measurements or model calculations are not utilized in studies of the very astrophysical puzzles that - in some cases - motivated their generation. The situation is getting worse as more nuclear measurements are being made but not incorporated into reaction rate libraries and other astrophysical datasets.

## NUCLEAR DATA STRATEGIES FOR ASTROPHYSICS

The effort in nuclear astrophysics data is insufficient to meet the needs of the community, and there is now a recognition of its importance at the international level [1]. While some efforts in recent years have yielded important progress [2, 3], there are a number of strategies that will ensure a more effective utilization of nuclear physics information in nuclear astrophysics. First and foremost, more manpower is needed for evaluations. It is, however, also important to exploit the overlap between the nuclear data and nuclear astrophysics communities [4] to avoid duplication of efforts (e.g., with statistical model codes). It is crucial to coordinate plans to evaluate nuclear reactions or structure properties on a national and international basis in order to share expertise and avoid duplications. These, and other data activities, would be greatly facilitated by the establishment of a Nuclear Astrophysics Data Coordinator [5, 6] whose duties would be to:

- Establish, maintain, and update a central WWW archive of relevant datasets;
- Modify archive datasets for compatibility with astrophysical codes;
- Improve data accessibility via the creation of indices, search capabilities, graphical interfaces, bibliographies, error checking, plotting tools, and other enhancements;
- Other activities such as: help coordinate international data activities; establishing and maintaining a nuclear astrophysics email distribution list; publicize new nuclear astrophysics meetings, experimental results, and publications; and establish and maintain a priority list of important nuclear reactions and properties that require further study.
- Maintain an active research program using nuclear data to ensure the data activities truly fulfill the needs of data users.

These goals are all very realizable, and would have an impact on nuclear astrophysics research efforts worldwide with only a modest investment.

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