

Structure and Decay Properties of Heavy Zr and N = 82 r-Process Nuclides*

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The nuclear structure and decay properties of the neutron-rich nuclides with $38 \leq Z \leq 46$ with $N \leq 82$ play a critical role in determining the path of the r-process and the abundances of heavy isotopes in the $A = 110$ to 140 region. The most recent models for the masses of these nuclides exhibits a strong effect from the $N = 82$ closed shell, that, in turn, enhances the neutron capture rate relative to the photodisintegration rate for these nuclides. As a consequence of these enhanced neutron capture rates, the resulting abundances resulting from r-process calculations are found to be much lower than the observed abundances in this mass region. [1]

Subsequently, calculations derived using a reduced shell strength for the lighter $N = 82$ isotones showed much better agreement with the observed yields. In this paper, the monopole effects of single-particle levels for both protons and neutrons in this mass region will be discussed and the various possible sources of the shell quenching enumerated.

Finally, possible experiments that would assist in the testing of these ideas with advanced facilities will be presented and discussed.

[1] K.-L. Kratz, B. Pfeiffer, F.-K. Thielemann, and W. B. Walters., *Hyperfine Interactions* **129** 185-221 (2000).

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