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## Predictability analysis of α decay formulae and the α partial half-lives of exotic nuclei.

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 $\alpha$  decay is one of the main decay modes of Super-heavy nuclei (SHN) and highly neutron deficient mediummass nuclei, collectively termed 'exotic' nuclei. In the synthesis of such nuclei and the radiochemical characterization of their longer-lived decay products, the identification is aided by the theoretical predictions of  $\alpha$  decay half-lives (T1/2) and decay energies. We examine the ability of 3 phenomenological alpha decay formulae, the Generalised Liquid Drop Model (GLDM), the Sobiczewski-Parkhomenko and the Viola-Seaborg formulae, to predict the  $\alpha$  partial T1/2 of 100 exotic nuclei by the statistical quantification of their accuracy and precision. These quantities were derived using a method based on standard experimental benchmarking wherein the  $\alpha$  spectroscopic data of 302 well-established alpha decaying nuclei (calibration data set) were used. Experimental masses as well as Finite Range Droplet Model masses were used to compute Q $\alpha$ . Improved coefficients for the three formulae were derived resulting in modified formulae. A simple linear optimization allowed adjustment of the modified formulae for the insufficient statistics of the odd-even and odd-odd decays of the calibration data set, without changing the modified formulae. Relatively better figures of merit for the odd-odd and the SHN were obtained using the modified GLDM formula.

## **Topic:**

Memorial session for W. Greiner

## Summary

This work analyses the predictive ability of 3 well-known analytical formulae of alpha decay towards predicting the alpha partial half-lives of exotic alpha emitters. The appropriate statistical analysis is presented as well as the modified formulae with improved coefficients. Prof. Greiner had made seminal contributions to the fields of alpha and cluster radioactivity and fission dynamics as well as in the physics of Super Heavy Nuclei, amongst others. It is only appropriate that this talk be presented in the Memorial Session for Walter Greiner, as my small contribution towards the collective homage to his legacy.

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