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MASS EXTRAPOLATIONS IN THE REGION OF DEFORMED RARE EARTH NUCLEI

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A striking aspect of the chart of nuclides in the rare earth region is the deep "gulf" present on the neutron rich side. In this "gulf" the last known isotopes are often only 4-6 neutrons away from the stable isotopes. The limit of nuclei for which masses are known comes even closer. The onset of important deformation effects starting above N=88-90 is another characteristic of the region. In addition, some isotopic chains contain a rather small number of measured masses, centered around the stable isotopes. All these facts make this region a difficult one for mass predictions. Indeed, a comparison between the values given by various models for the isotopes beyond the last measured one indicates a growing divergence when one goes away from the last experimental values.

Based on the global property of regularity of the surface of masses, a method has been developed to extrapolate starting from the known masses into the adjacent regions. By principle, this method could provide reliable extrapolations for the next 4-5 masses, but in some particular cases its range of validity may extend further away.

The application of this procedure to the region of masses with $50 \leq Z \leq 82$ and $82 \leq N \leq 126$ from which the deformed nuclei have been excluded lead to a hypothetical smooth mass surface for which the deformations were absent. By comparing to the real mass surface, the deformation region shows up prominently, presenting neat contours and a well developed symmetry. These characteristics can be exploited for a guided guess of the limits up to which the deformed region extends. The amplitude of the overbinding brought by the deformation could also be estimated and amounts to 5MeV at the maximum of this effect (for 168Dy). Interestingly, most of the systematic values given in the tables of Audi and Wapstra [1], lay very close or overlap the extrapolated values. Tables are provided for the masses of all nuclei supposed to belong to the deformation region and that are not yet measured.

New mass measurement in this region, the sole criterium of validity for extrapolations and mass models are strongly advocated.

References:

1. G. Audi and A. H. Wapstra, Nucl. Phys. A565(1993), 1