

Evaluation of nuclear radius parameter (r_0) for even-even nuclei

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The present study is initiated to update an earlier evaluation of radius parameter (r_0) [1] in the context of alpha decay of even-even nuclei, which is used in the deduction of hindrance factors for alpha decays of odd-A and odd-odd nuclei. In this evaluation, the nuclear radius parameter of a total of 154 even-even alpha emitters ($50 \leq Z \leq 100$ and $52 \leq N \leq 152$) was deduced using Preston's spin-independent formalism [2] for alpha-decay transition probabilities. Since the previous evaluation by Akovali [1] in 1998, extensive new and improved data for half-lives of alpha-decaying even-even parent nuclei, alpha-decay branching ratios, and energies of alpha transitions have become available which motivated us to update the earlier evaluation [1]. In addition, new mass evaluation [3] is now available which reflects updated Q values for alpha decays of even-even nuclei. The radius parameters, deduced in the current evaluation can be used to deduce the hindrance factors for alpha decays of the odd-odd and odd-A nuclei, which can serve as a crucial parameter to extract the spins, parities and configurations of states involved in a particular alpha decay. The systematic of the deduced radius parameter (r_0) of alpha-daughter nuclei with alpha-parent neutron number for odd-odd and odd-A nuclides will be presented. The deduction of radius parameter for odd-odd and odd-A nuclei, based on an assumption that r_0 for such nuclides can be obtained from an interpolation of r_0 values of adjacent even-even neighbors [4], will also be discussed [5].

Acknowledgements

This project is partially supported by a grant at M.M. University from the International Atomic Energy Agency (IAEA), Vienna, Austria.

References

- [1] Y. A. Akovali, Nuclear Data Sheets **84**, 1 (1998).
- [2] M. A. Preston, Phys. Rev. **71**, 865 (1947).
- [3] M. Wang et al, Chinese Physics C **36**, 1603 (2012).
- [4] M. J. Martin, *Calculation of radius parameter r_0 for Odd-A and Odd-Odd nuclides* (2007).
- [5] Sukhjeet Singh et al., (2015) *RadD* (<https://www.nds.iaea.org/public/ensdf/pgm/index.htm>)