# DEPENDENCE OF DEFORMATION OF EXOTIC NUCLEI FROM THE HALF-LIFE

Zaripova Yu.A.[1], Dyachkov V.V.[1], Sereda Yu.M.[2], Yushkov A.V.[1]
[1] *Scientific Research Institute of Experimental and Theoretical Physics, Almaty, Republic of Kazakhstan;* [2] *Joint Institute for Nuclear Research, Dubna, Russia*
E-mail: ZJ_KazNU@mail.ru

The deformation of nuclei is usually measured by their excitation into lower collective rotational states $2^+$ with the subsequent extraction of nuclear matrix elements. The nuclear quadrupole deformation parameter is uniquely related to these elements $\beta_2$ [1]. However, this method is unsuitable for exotic short-lived nuclei, the inelastic scattering on which is difficult to measure, and for odd nuclei is impossible at all.

The authors of this work managed to find a correlation between the parameter $\beta_2$ and half-life $T_{1/2}$ for oblate nuclei with sign$\beta_2 < 0$ and anti-correlation for elongated nuclei sign$\beta_2 > 0$. As a result analytical expressions for the function $\beta_2(T_{1/2})$ have been obtained. For example, for elongated spheroids

$$\beta_2\left(T_{1/2}^{\beta^+}\right) = -0{,}0109 \cdot lnT_{\frac{1}{2}}^{\beta^+} + 0{,}3444, \qquad at\ \text{sign}\beta_2 > 0,$$

$$\beta_2\left(T_{1/2}^{\beta^-}\right) = -0{,}008 \cdot lnT_{\frac{1}{2}}^{\beta^-} + 0{,}2823, \qquad at\ \text{sign}\beta_2 > 0.$$

These relations make it possible to calculate with a high accuracy (from 5 to 10%) the parameters of the shape of the nuclei $\beta_2$, knowing the half-lives $T_{1/2}$ for the exotic nuclei for which this quantity is most accurately measured. Figure 1 shows such calculations for isotopic cerium (Fig. 1a) and tellurium (Fig. 1b) series in comparison with experimental half-life values [2, 3].

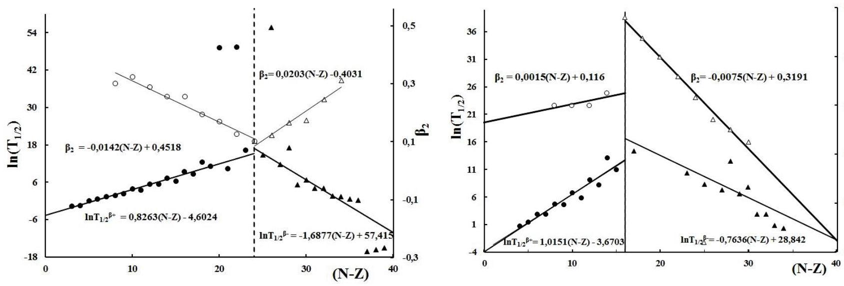


*Fig. 1. The phenomenon of $\beta_2$ anti-correlation with $T_{1/2}$ for oblate nuclei (a) and $\beta_2$ correlation with $T_{1/2}$ elongated nuclei (b).*

1. A.V.Yushkov // Physics of Elementary particles and Atomic Nuclei. 1993. V.24(2). P.348.
2. N.N.Pavlova *et al.* // IZVESTIYA AKADEMII NAUK SSSR SERIYA FIZICHESKAYA. 1979. V.43. P.2317.
3. Nuclear Structure and decay Data: https://www.nndc.bnl.gov/nudat2/