Contribution ID: **376** Type: **Oral report**

PAIRING ENERGIES OF ODD ACTINIDE NUCLEI IN FIXED QUANTUM STATES

Tuesday 21 September 2021 17:30 (25 minutes)

The pairing energies (PE) of nonmagic atomic nuclei with $A \geq 50$ can be derived from the odd nuclei masses M provided it is possible to present M as a sum of two terms [1]:
1) a smooth function of nucleon numbers having the same form of Tailor series expansion for even-even and odd nuclei;
2) PE: $P_n(N', Z)$ and $P_p(N, Z')$, where $N(N')$ and $Z(Z')$ denote even (odd) numbers of neutrons and protons and indices $n(p)$ refer to neutron (proton) PE.

Traditionally the masses of two adjacent odd nuclei is used for calculations of PE and this procedure smoothes out the influence of the state of odd nucleon on PE. To overcome this problem, we have proposed [2] the expression for PE, which includes only one odd nucleon mass. This expression is based on the assumptions 1), 2) and Taylor series expansion of mass surface up to the third order in the number of nucleons. For example,
$P_n(N', Z) = M(N', Z) - \frac{9}{16}[M(N'+1, Z) + M(N'-1, Z)] +$
$+\frac{1}{16}[M(N'+3, Z) + M(N'-3, Z)]$
The results of calculations of pairing energies of deformed $\mathrm{U(Z = 92)}$ and $\mathrm{Pu(Z = 94)}$ actinide nuclei with Nilsson quantum numbers $K^\pi\,[Nn_z\lambda]$ of odd neutron quasiparticles are given in the
Table. The masses of nuclei are taken from Atomic Mass Evaluation - AME2020 [3]. The results obtained confirm our conclusion about the dependence of PE on the state of an odd nucleon.

N'	Z	P_n, keV	$K^\pi\,[Nn_z\lambda]$ neutrons	N'	Z	P_n, keV	$K^\pi\,[Nn_z\lambda]$ neutrons
141	92	573	$5/2^+[633]$	143	94	564	$7/2^-[743]$
143	92	626	$7/2^-[743]$	145	94	520	$1/2^+[631]$
145	92	578	$1/2^+[631]$	147	94	551	$5/2^+[622]$
147	92	574	$5/2^+[622]$	149	94	454	$7/2^+[624]$

References:
1. D.G. Madland, J.R. Nix, Nucl. Phys. A **476**, 1 (1988).
2. A.K. Vlasnikov, A.I. Zippa, V.M. Mikhajlov, Bull. Russ. Acad. Sci.: Phys. **80**, 905 (2016); **81**, 1185 (2017); **84**, 919 (2020); **84**, 1191 (2020); **84**, 1309 (2020).
3. https://www-nds.iaea.org/amdc/

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Session Classification: Section 1. Experimental and theoretical studies of the properties of atomic nuclei

Track Classification: Section 1. Experimental and theoretical studies of the properties of atomic nuclei.