ON ROTATIONAL BANDS WITH $K^{\pi} = 0^{+}{}_{2}, 2^{+}{}_{2}$ AND $1^{+}{}_{1}$ IN ^{160}Gd, ^{164}Dy AND ^{166}Er

Govor L.I., Demidov A.M., Kurkin V.A., Mikhailov I.V.
National Research Center "Kurchatov Institute", Moscow, Russia
E-mail: l.govor@mail.ru

In our investigations of γ-rays in the (n,n'γ) reaction on ^{160}Gd [1], ^{164}Dy [2] and ^{166}Er [3] we established the completeness of level schemes with $J^{\pi} = 0^{+} \div 4^{+}$ in these nuclei up to 1.9 MeV excitation energy. Obtained in these works results allowed to define that problems arising at construction of rotational bands with $K^{\pi} = 0^{+}{}_{2}$ and $2^{+}{}_{2}$ exist in all of these nuclei (for ^{166}Er see also [4]). In particular, the levels with $J^{\pi}K = 2^{+}0_{2}$, $4^{+}0_{2}$, $3^{+}2_{2}$, $4^{+}2_{2}$ were not found at the expected excitation energies. The energies of head levels for bands with $K^{\pi} = 0^{+}{}_{2}$, $2^{+}{}_{2}$ and $K^{\pi} = 1^{+}{}_{1}$ are given in the table in keV units.

K^{π}	^{160}Gd	^{164}Dy	^{166}Er
$0^{+}{}_{2}$	1558.37	1779.14	1713.41
$2^{+}{}_{2}$	1586.69	1706.66	1703.10
$1^{+}{}_{1}$	1568.69	1840.67	1812.76

The one of possible explanation is that Coriolis interaction leads to the confluence of states with $J^{\pi}K = 2^{+}0_{2}$ and $2^{+}1_{1}$, $3^{+}2_{2}$ and $3^{+}1_{1}$, $4^{+}0_{2}$ and $4^{+}1_{1}$ since the presence of $K^{\pi} = 1^{+}{}_{1}$ band levels plays important role in this interaction [5].

Another reason of discussed phenomenon may be connected with distribution of Nilsson two-quasiparticle states among bands. There are two groups of Nilsson states expected in this excitation energy region: a) the ν[521]↓, ν[521]↑, ν[523] ↓, π[411]↓, π[411]↑ and π[413]↓ states with small orbital momenta and b) the neutron $1i_{13/2}$ subshell states (ν[651]↑, ν[642]↑, ν[633]↑) and the proton $1h_{11/2}$ subshell ones (π[532]↑, π[523]↑) with large orbital momenta [5,6] (the latter set states determine the nonspherity of nuclei). The neighbour states of the second group cannot participate in creating the $K^{\pi} = 2^{+}{}_{2}$ band (in contrast to the $1^{+}{}_{1}$ band). Pairs with $J^{\pi} = 0^{+}$ give small contributions into $K^{\pi} = 0^{+}{}_{2}$ band in ^{160}Gd and ^{166}Er but put essential contribution into in ^{164}Dy (νν[633]↑ state) [6]. It is possible in ^{164}Dy the essential Coriolis interaction of levels for $K^{\pi} = 1^{+}{}_{1}$ and $K^{\pi} = 0^{+}{}_{2}$ bands is expected. The factors mentioned above should have an influence on the $K^{\pi} = 0^{+}{}_{2}$ and $2^{+}{}_{2}$ band structure in ^{160}Gd, ^{164}Dy and ^{166}Er.

1. L.I.Govor *et al.* // Phys. At. Nuclei. 2009. V.72. P.1799.
2. L.I.Govor *et al.* // LXIII International Conference NUCLEUS 2013. Book of abstracts. 2013. P.84.
3. L.I.Govor *et al*. // LXIV International Conference NUCLEUS 2014. Book of abstracts. 2013.
4. E.P.Grigoriev // Yad. Fiz. 1994. V.57. P.590.
5. A.Bohr, B.R.Mottelson. Nuclear Structure. V.2. New York, Amsterdam, 1974.
6. V.G.Soloviev *et al*. // Fiz. Elem. Chastits At. Yadra. 1996. V.27. P.1643; Phys. Part. Nucl. 1996. V.27. P.667.