

GAMMA-SPECTROSCOPIC INVESTIGATION OF COLLECTIVE BANDS
IN ^{77}Kr WITH THE REACTION $^{63}\text{Cu}(^{16}\text{O},\text{pn})$

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$^{77}_{36}\text{Kr}_{41}$ is an odd neutron ($g_{9/2}$) nucleus which is lying close to the expected region of maximum nuclear deformation for nuclei with $28 \leq N, Z \leq 50$. This is seen from fig. 1, where the energies of the first excited 2^+ states of the e-e nuclei are plotted versus the neutron and proton number $|1|$. From this plot one would expect the region of maximum deformation near $^{76}_{38}\text{Sr}_{38} - ^{78}_{38}\text{Zr}_{40}$. $^{77}_{36}\text{Kr}_{41}$ is lying close to these nuclei.

^{77}Kr has been studied via the strong reaction $^{63}\text{Cu}(^{16}\text{O},\text{pn}\gamma)$ with the help of the standard techniques of in-beam γ ray spectroscopy: excitation functions, $\gamma\gamma$ coincidences and angular distributions.

The $\gamma\gamma$ coincidences were measured with two coaxial Ge(Li) detectors. The results of the coincidence spectra are summarized in fig. 2. Two separate cascades were observed which are not connected by interband transitions. The assignment of the two cascades to ^{77}Kr was done with the help of the cross bombardments $^{64}\text{Ni}(^{16}\text{O},3\text{n})$, $^{64}\text{Zn}(^{16}\text{O},2\text{pn})$ and $^{66}\text{Zn}(^{16}\text{O},\text{an})$. The two cascades were ordered with the help of the line intensities of the angular distribution measurement. The angular distribution coefficients of the transitions between adjacent levels are consistent with stretched dipole radiation, those of the cross-over transitions with stretched quadrupole radiation. To determine the half-life of the 66.5 keV state, a $\gamma\gamma$ coincidence measurement was performed with a planar Si(Li) and a coaxial Ge(Li) counter. The 66.5 keV line was detected by the Si(Li) counter.

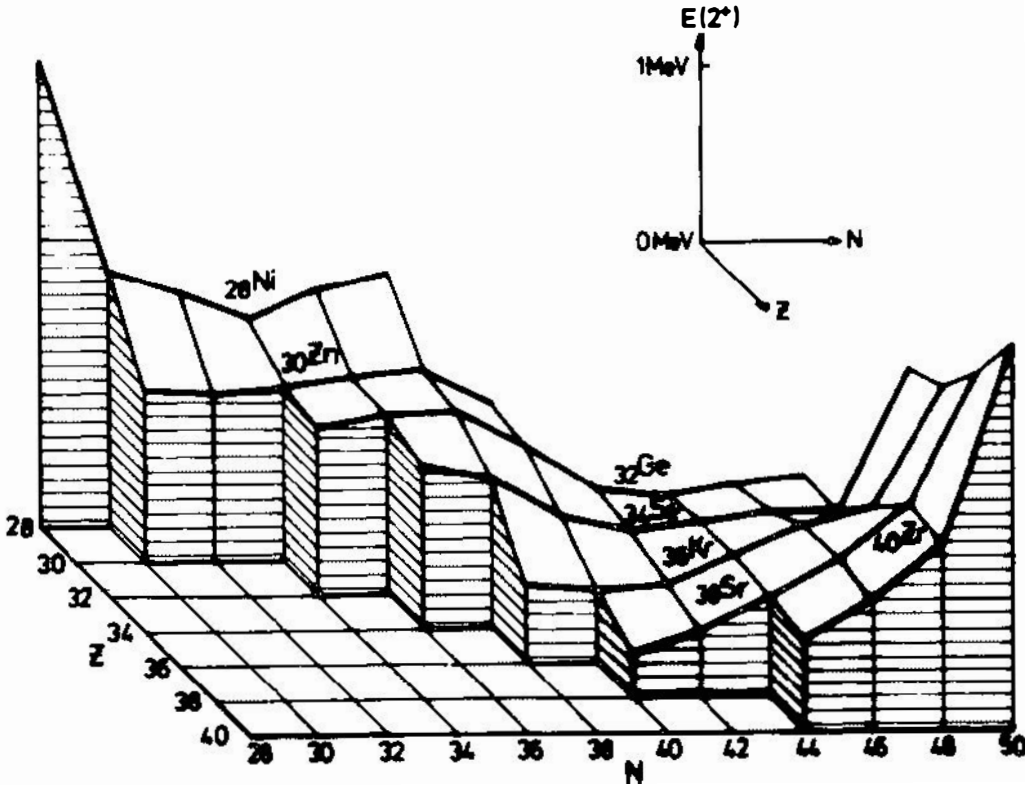


Fig.1. Energies of the first excited 2^+ state of e-e nuclei in the region $28 \leq N, Z \leq 50$.

The half-life was determined to be 118 ± 20 nsec. The levels at 66.5, 150.1, 245.3 and 499.6 keV are also observed in the β decay of ^{77}Rb [2,3,4].

For the assignment of $5/2^+$ to the ground state of ^{77}Kr we used the results of a study of the β -decay of ^{77}Kr [5] and new results of in-beam measurements in ^{77}Br [6,7]. The $\log ft$ values to the states in ^{77}Br at 129.7 keV ($5/2^+$; $\log ft = 5.5$), at 276.2 keV ($3/2^+$, 5.4) and at 418.4 keV (6.5) [5] and the angular distribution coefficients of the 276 keV line ($A_2 = 0.27 \pm 0.15$, $A_4 = -0.14 \pm 0.25$) and of the 312 keV line ($A_2 = -0.19 \pm 0.06$) [6] deexciting the 418.4 keV level allow only $J^\pi = 5/2^+$

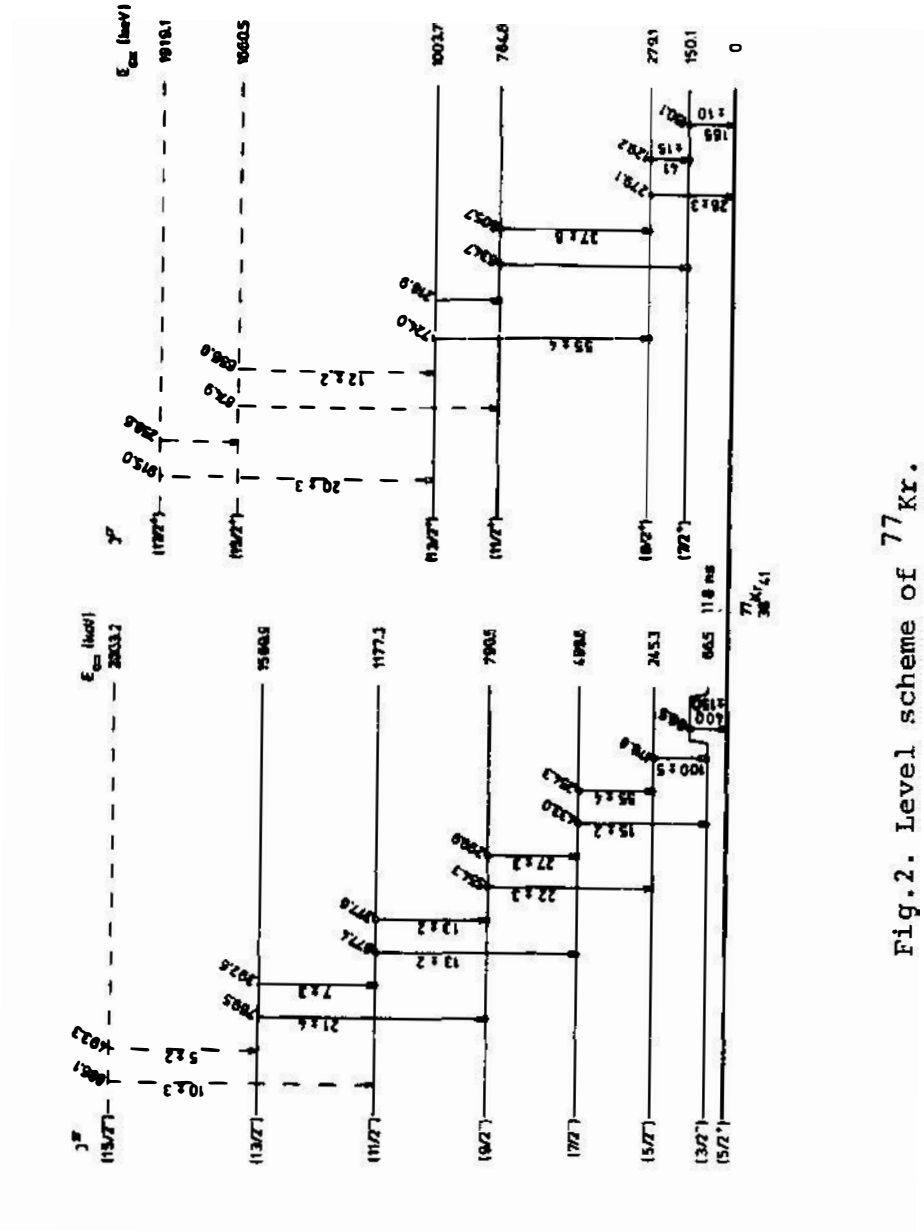


Fig.2. Level scheme of ^{77}Kr .

for the ground state of ^{77}Kr .

Since no ground state transitions of the cascade built on the 66.5 keV level were observed, this band should have negative parity. The measured half-life of 118 nsec for the 66.5 keV transition is only possible for the multipolarity E1. The $B(E1)$ -value of 10^{-5} W.u. is similar to other values measured in ^{68}Ge [8].

The spin of the 66.5 keV level is, therefore, $3/2^-$, $5/2^-$ or $7/2^-$. With respect to the β decay data of ^{77}Rb , $J^\pi = 3/2^-$ seems more probable to us. The proposed spin assignment for the two bands in ^{77}Kr is shown in fig. 2. Both bands have the spin sequence $J, J+1, J+2 \dots$.

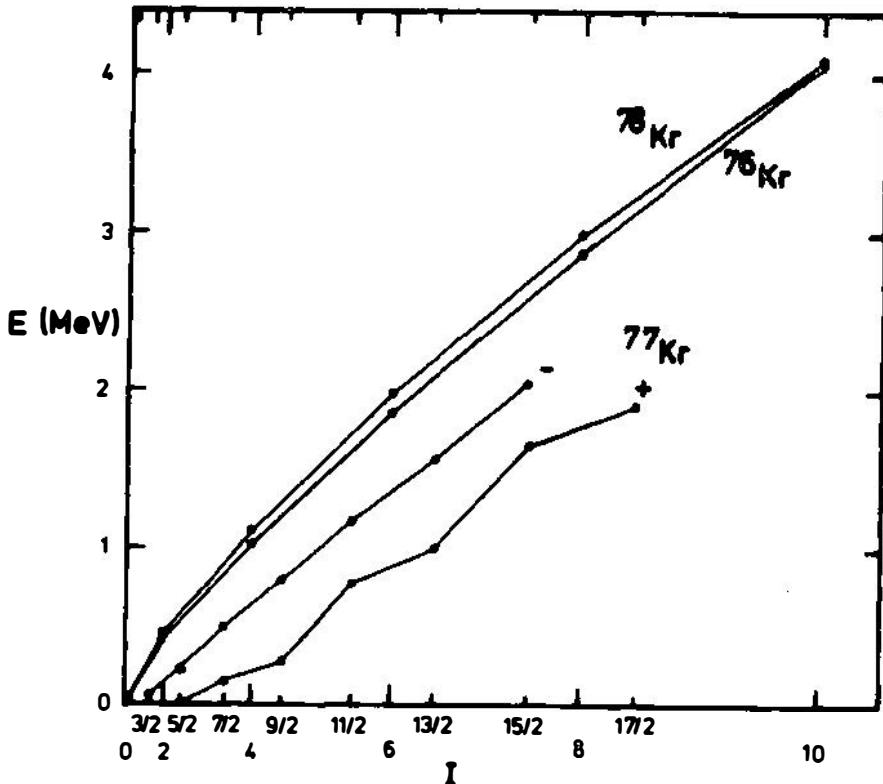


Fig.3. Level energies of ^{77}Kr , ^{76}Kr and ^{78}Kr versus $J(J+1)$.

In fig. 3 the energies of these bands are plotted versus $J(J+1)$. Both bands are more rotational-like than the ground state bands of the neighbours ^{76}Kr and ^{78}Kr . The negative parity band is approximately described by $E \approx 34 \text{ keV} \cdot J(J+1)$, the positive parity band by $E \approx 30 \text{ keV} \cdot J(J+1)$. The two bands are not decoupled.

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