γ-vibrational states in ^{180}Ta ◇

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1. Motivation

Recent experiments showed that assuming realistic branching ratios, large matrix elements are needed to explain the measured cross sections depopulating the K=9$^-$ isomer in ^{180}Ta to its K=1$^+$ unstable ground-state [1,2]. The energies of the lowest intermediate states connecting the isomer and the ground-state are known to lie between 1.0 and 1.5 MeV [2,3], but spins and precise energies of the intermediate states are unknown. Vibrational states are possible candidates for intermediate states.

2. Experimental set-up

A 5.6 % in ^{180}Ta enriched Tantalum oxide target was bombarded with 225 MeV ^{58}Ni projectiles accelerated by the Tandem van de Graaff of the Niels Bohr Institute. For comparison a similar, but natural Tantalum oxide target was irradiated, too. For each target coincidences were recorded between 55 PIN diodes and NORDBALL's Compton-suppressed Ge-detectors.

3. Results

Fig. 1 shows a projectile-gamma coincidence spectrum after subtraction of the natural data from the normalized enriched data. Three lines can be seen clearly. The I=11$^-$ line at 1262 keV is known from [4,5]. Our data is in agreement with a band proposed on the K=11$^-$ state in [5]. In this publication a 1013 keV transition to the I=10$^-$ first rotational state of the K=9$^-$ isomeric band was seen. We think that this line comes from the decay of the I=8$^-$ first rotational state at 1289 keV belonging to the K=7$^-$ γ-vibrational band with bandhead at 1134 keV. Tentatively additional lines can be seen at 947, 1141 and 1188 keV. Their origin is unknown, but they must have "collective character". In fig. 2 the lowest states of the proposed γ-vibrational bands in ^{180}Ta are shown. The computer code GOSIA [6] was used to calculate the interband B(E2) values. For the B(E2,7$^-$ $\rightarrow$ 9$^-$) and B(E2,11$^-$ $\rightarrow$ 9$^-$) we get about 8 W.u..

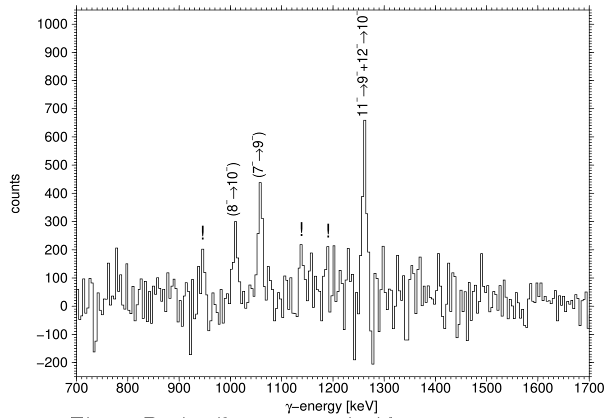

Fig. 1: Projectile-gamma coincidence spectrum

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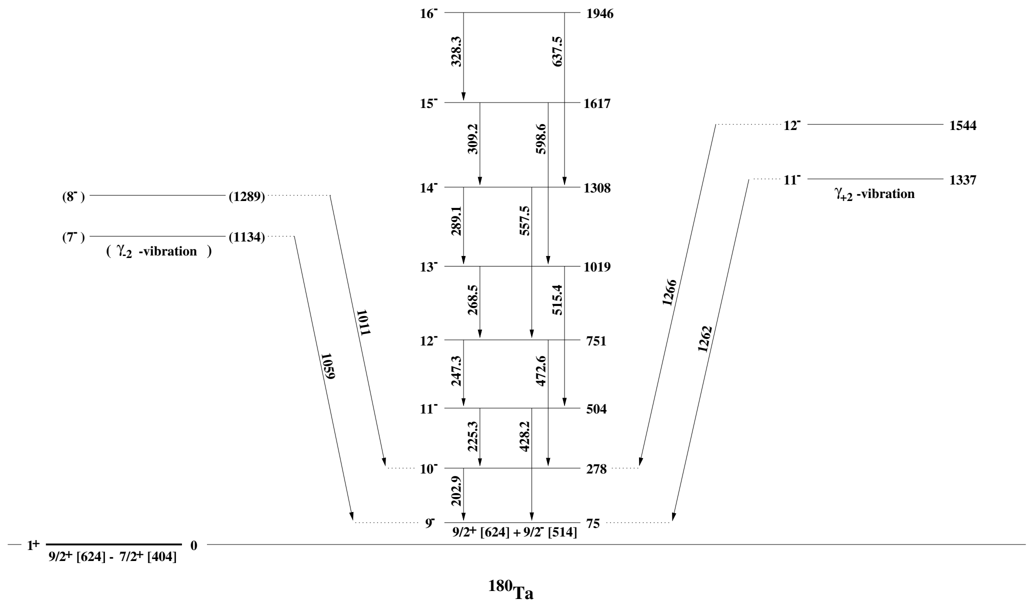

Fig. 2: Proposed γ-vibrational bands in ^{180}Ta

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