Population of Isomers in ^{181}Ta via Coulomb Excitation ◇

M. Loewe, P. Alexa [a], J. de Boer, J. Choinski [b], T. Czosnyka [b], J. Iwanicki [b], H. J. Maier, P. J. Napiorkowski [b], P. Olbratowski [c], G. Sletten [d], J. Srebrny [c], and M. Würkner

[a] Inst. of Chem. Techn., Techn. Univ. Prague, Czech Rep. [b] Heavy Ion Lab., Univ. of Warsaw, Poland
[c] Nuc. Phys. Div., Inst. of Exp. Phys., Univ. of Warsaw, Poland
[d] Niels Bohr Inst. Tandem-Accel.-Lab., Risø, Denmark

1. Motivation

The population of isomers via Coulomb Excitation was observed in several experiments. The population mechanism is often not fully understood, especially in cases where the K quantum numbers of the Coulomb-excited and the isomeric state differ by several $\hbar$ [1].

2. Experimental Setup

The experimental set-up for studying the population of isomers in ^{181}Ta is described in [2].

3. Results

In our Coulomb Excitation experiment the negative-parity band on the K=$9/2^-$, $T_{1/2}$=6.05 μs isomer and the K=$5/2^+$, $T_{1/2}$=10.8 ns isomer were populated. Interband transitions between the ground-state band and the negative-parity band could be observed for the first time. The feeding of the K=$9/2^-$ band through the K=$7/2^+$ ground-state band is too weak to explain the observed population of the negative-parity band. Calculations with the computer code GOSIA [3] showed that additional direct E3 Coulomb Excitation of the negative-parity band is needed. A B(E3) value of (6.4 ± 0.3) W.u. for the K=$7/2^+ \rightarrow$ K=$9/2^-$ bandhead excitation was found.

It is interesting to note that a part of the population of the K=$5/2^+$ isomer follows the loop through the K=$3/2^+$ γ-vibrational band. The vibrational band is populated by strong E2 excitation [2] as shown in fig. 1. (A comparable scenario might be responsible for the depopulation of the K=9^- isomer in ^{180}Ta to the unstable K=1^+ ground-state via Coulomb Excitation.)

The known K=$7/2^+$ ground-state band in ^{181}Ta was observed up to spin I=$29/2^+$. The intrinsic quadrupole moment Q_O of the ground-state band was analyzed with GOSIA in the framework of the rotational model. The result of $Q_O = (6.71 \pm 0.08)$ eb is in good agreement with the value of B. Olaniyi et al.: (6.80 ± 0.03) eb [4]. It must, however, be noted that these values are smaller than $Q_O = (7.03 \pm 0.13)$ eb given by J. Konijn et al. [5].

References

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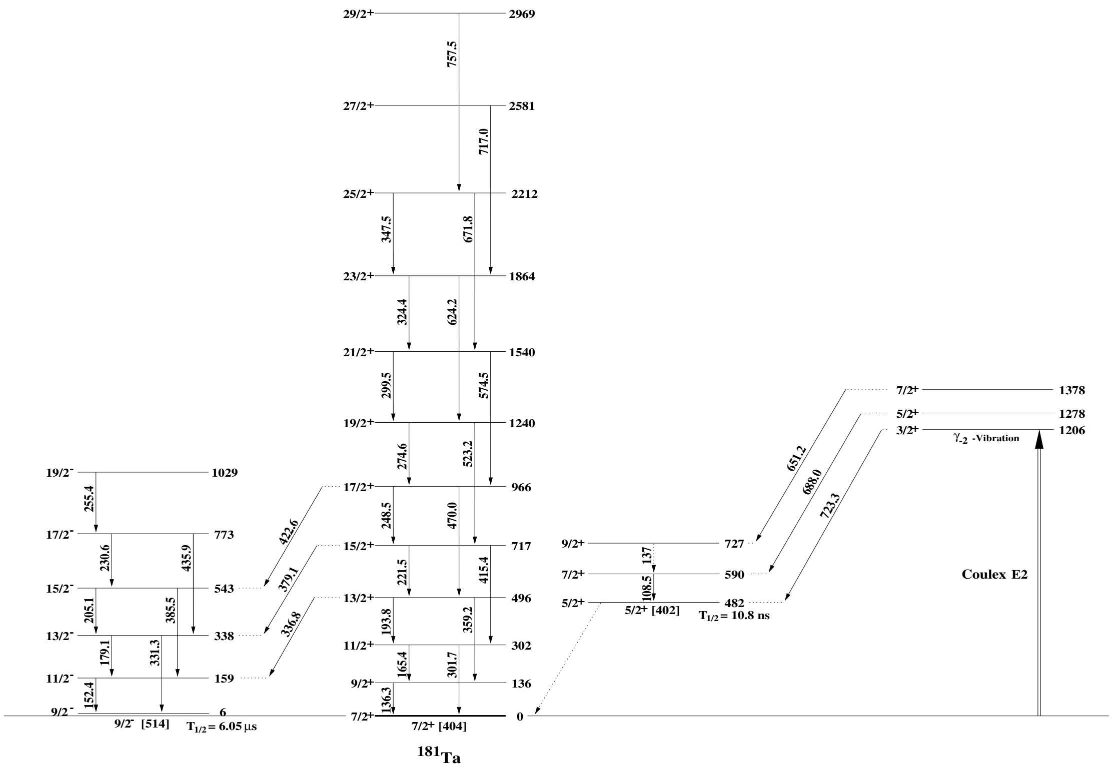

Fig. 1: Vibrational band in ^{181}Ta

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