Lifetime measurement of 19/2 isomer in ^{175}Re

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Introduction

There has been much interest in the mass region A $\sim$ 180 to understand the deformation associated with the intruder bands. In this region, proton and neutron Fermi surfaces are well separated and proton and neutron pairing correlations are largely decoupled. For the neutrons, the deformation associated with the $h_{9/2}$ was predicted to remain stable with increasing spin and to be unaffected by the alignment of $i_{13/2}$ neutrons. The predictions for the proton $i_{13/2}$ bands were much different[1]. It is interesting to measure the deformation associated with high-K isomers elucidating the dependence of pairing correlations and nuclear shapes on the multi-quasiparticle configurations, and the decay mechanisms governing their decay to lower-lying states.

The half-life of 19/2 isomer [E = 1793.8keV, $T_{1/2} \sim$ 27 ns] in ^{175}Re [2] is well suited for quadrupole moment measurements using the time differential perturbed angular distribution (TDPAD) method. We are reporting here the half-life time of the state as a part of the quadrupole measurement of the state.

Experimental Details

The experiment was performed using PAD facility at Inter University Accelerator Center (IUAC), New Delhi. The 19/2 isomeric state in ^{175}Re was populated and aligned in the reaction using ^{16}O pulsed beam with 250 ns time interval at 104 MeV energy. The ^{165}Ho target of thickness 700 μg/cm^2 backed by 211 mg/cm^2 thick natural Re foil was prepared through evaporation technique at target laboratory IUAC, New Delhi.

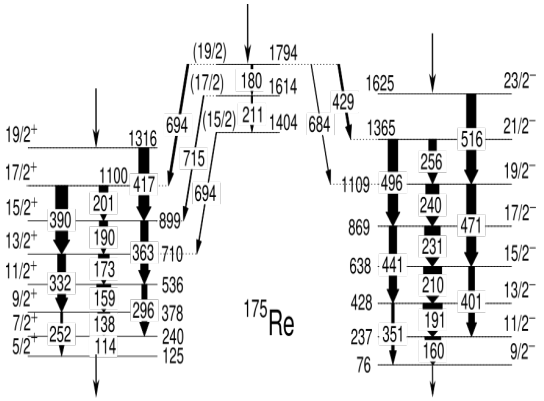

FIG. 1: Partial level scheme of ^{175}Re.

Data Analysis and Results

For the offline analysis of acquired data, two matrices of energy versus time for each detector were formed with gain matching of energy signals for both the detectors. From these matrices time-gated energy spectra and energy gated time spectra were formed. FIG. 1 illustrates the partial level scheme of ^{175}Re, which depicts the decay of the isomer of interest.
These matrices were then used to create time-gated energy spectra and energy-gated time spectra for the system. The time spectra was gated from 300 keV to 500 keV energy as the gamma rays in this energy range have posi-

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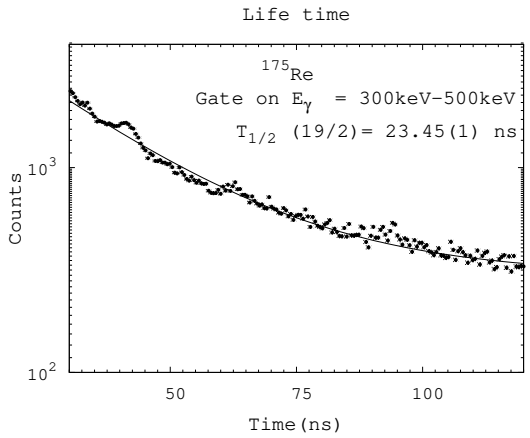

FIG. 2: Summed time spectra with gates on γ transitions from the 19/2 isomeric state in ^{175}Re. The solid curve shows the least-squares fit to the data.

tive anisotropy coefficient. The time spectra of both the $LaBr_3$(Ce) detectors were added after matching the time zero (T_0), normalization and background subtraction.

The summed time spectra were LSQ fitted to the exponential decay to extract the half-life of the state. The LSQ fitted decay spectra for 19/2 isomeric state is shown in FIG. 2. The measured half life, $T_{1/2}$ = 23.45(1) ns is in good agreement with the results of previous measurements [2]. The spin and parity of the band-head of the isomeric band have not been established. The shape of the quadrupole interaction pattern in present measurements is expected to reveal the spin of the state.
The reported results are the part of the experiment carried out for the quadrupole moment measurements of the state. Further analysis for the quadrupole moment measurement is in progress.

Acknowledgments

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References

[1] R. A. Bark, R. Bengtsson, H. Carlsson, Phys. Lett. B **339**, 11 (1994)..
[2] T.Kibdi et al., Nucl. Phys. A **539**, 137-162 (1992).