The lifetime measurement of MR Band head ($27/2^- \rightarrow 25/2^+$, E1 432 keV transition) in Pb-197 using Pulsed Beam Method

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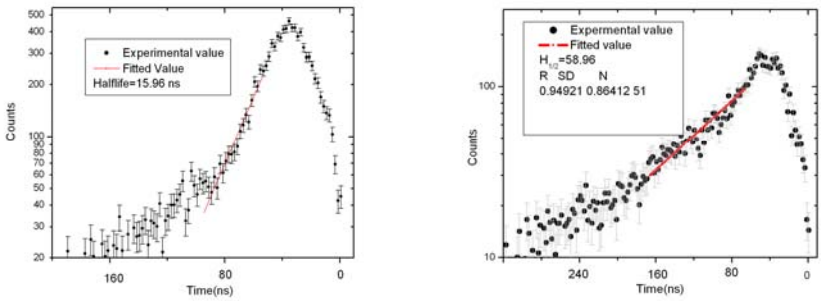
More than a decade ago, H. Hubel in Germany and R.M. Clark in U.K., observed regular pattern of γ -rays in the spectra of ^{198}Pb and ^{199}Pb nuclei, which are nearly spherical in nature. Such bands are termed as Magnetic Rotational (MR) Bands or Magnetic Dipole Bands and subsequently also as Shears Bands [1]. A large transverse magnetic dipole moment is generated, when high-j protons are coupled to high-j neutrons holes or vice versa. The particle-hole coupling gives the lowest energy for a perpendicular coupling of the particle and hole angular momenta [2].

First evidence on perpendicular coupling was reported by a measurement of the g-factor of the 2584-keV band head of the M1 band in ^{193}Pb [3]. The same experiment also confirmed that the band has $[\pi(h_{9/2}i_{13/2})_{11}^- \otimes \nu i_{13/2}^{-1}]_{29/2}^-$ structure. In the ^{197}Pb nuclei, similar type of band structure exits at 3283-keV. In order to confirm the perpendicular coupling and assign exact configuration for this band structure in ^{197}Pb nuclei, an experiment has been planned to investigate the lifetime and the g-factor of lowest band head state (isomeric state with E1 transition of 432 keV) of Magnetic Rotation band in ^{197} Pb using Pulsed beam method. In the first stage, we have carried out the lifetime measurements of this band head.

The ^{197} Pb nucleus was populated using the reaction ^{186} W (^{16}O, 5n) ^{197}Pb at 97 MeV. The ^{16}O pulsed beam with pulse width 1.2 ns and period 250 ns was delivered by 15-UD Pelletron accelerator at Nuclear Science Centre, New Delhi. Self-supporting enriched ^{186}W target of thickness 1.5 mg/cm^2 was used. The time calibration is done online by r. f. signal, which gives time calibration of 0.1ns per channel. In order to measure the lifetime; we have made the E_γ-t (4K × 1K) using all detectors by Millier Package. The depopulation of $27/2^-$ isomer at 3283-keV of the interest by the 432.5 keV and the half-life measured by 432.5 keV transition is 15.96 ns (Fig .1). The half-life of $33/2^+$ isomer is measured by the depopulation of the isomer by 606.5 keV. The lifetime of this isomer is 58.96 ns (Fig.2). This half-life is consistent with pervious known half-life 55±5 ns [4].



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