Magnetic moments and hyperfine fields with $LaBr_3$ detectors and pulsed beams

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Recent developments have made $LaBr_3$ gamma ray scintillation detectors available. These offer better timing resolution than germanium (HPGe) detectors, but with better energy resolution than scintillators such as Barium Fluoride (BaF_2) and Sodium Iodide (NaI). The combination of excellent time resolution and good energy resolution opens up new research opportunities. One such application is to use $LaBr_3$ detectors for the measurement of the high frequency precessions of short-lived isomers in strong internal fields, in beam, using Time Differential Perturbed Angular Distribution (TDPAD) methods.

Experiments have been conducted at the ANU to gain experience, and determine the limits of $LaBr_3$ detectors in this context. Precessions have been successfully observed in states with lifetimes ranging between $\sim$ 100 ns and $\sim$ 3 μs, with precession periods ranging from 40 ns to 3 ns (well below the time resolution of HPGe detectors).

TDPAD methods allow internal hyperfine fields and nuclear g factors to be determined. The case of the internal field of Cd in gadolinium is of interest as it relates to a particular g-factor measurement of the 10^+ state in ^{110}Cd which was smaller than expected [1]. To clarify this discrepancy, the hyperfine fields of ^{107}Cd implanted into gadolinium were studied by TDPAD with $LaBr_3$ detectors. A pulsed 48 MeV beam from the ANU 14UD Pelletron accelerator was employed together with the ^{98}Mo(^{12}C, 3n)^{107}Cd reaction. Results of the experiments will be reported, and implications for the g(10^+) measurement in ^{110}Cd will be discussed along with the benefits and limitaions of the method.

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[1] P. H. Regan, A. E. Stuchbery, S. S. Anderssen, *Nucl. Phys. A* **591**, 533 (1995).