First Measurement of an Isomeric Quadrupole Moment in Fragmentation Reactions: the case of ^{61}Fe(9/2$^+$)

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The discovery of spin alignment in intermediate energy projectile fragmentation reactions [1] has led to the opportunity to measure nuclear moments of neutron-rich isomers. A powerful method to study moments of isomeric states is the well-known Time Differential Perturbed Angular Distribution technique (TDPAD), which has been successfully applied to study isomers in fusion evaporation reactions. The last few years our collaboration has achieved considerable progress in the extension of this technique to fragmentation isomers. Following a pioneering experiment to measure g-factors [2], several experimental improvements have enhanced the sensitivity dramatically [3], thus making it possible to go a step further and measure a quadrupole moment.

As the first candidate for a quadrupole moment measurement, we have chosen the ^{61}Fe(9/2$^+$) isomeric state (Figure 1), built on the intruder $\nu g_{9/2}$ orbital. The g-factor of this state was measured a few years ago and demonstrated that at least 15% of spin alignment can be expected for this isomer [3]. Comparison of the obtained g-factor with LSSM calculations indicated a deformed structure for this state, which motivated a subsequent quadrupole moment measurement. The isomers of interest were populated and aligned following the fragmentation of a 64.6 MeV/u ^{64}Ni beam and selected by the LISE spectrometer at GANIL. The quadrupole moment was obtained by combining the TDPAD method with the heavy-ion-gamma correlation technique [4]. The presentation will focus on the particular aspects of the experimental technique and the deduced quadrupole moment $|Q| = 41(6) efm^2$ will be compared with theoretical models.

The present measurement constitutes the first determination of a quadrupole moment in a fragmentation reaction and paves the way for future measurements in more exotic nuclei.

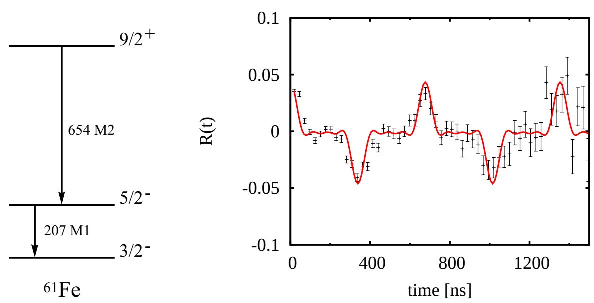

Figure 1: *Level scheme of ^{61}Fe and the R(t) function derived from the 654 keV M2 transition.*

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