# Calibration of the Transient Field of $^{46}Ca(2_1^+)$ Precession in Gadolinium with the Known $g$ Factor of $^{46}Ti(2_1^+)$ ◇

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Precise measurements of precessions of the $^{46}$Ca($2_1^+$) state at the 88-*Inch* cyclotron at Berkeley with an intense isotopically pure $^{46}$Ca beam forced to calibrate the transient field with the known $g$ factor, $g = +0.496(27)$, of $^{46}$Ti($2_1^+$) ions [1], under most similar experimental conditions to the Ca ions using the same target. The target consisted of 0.423 $mg/cm^2$ $^{nat}$C on 3.24 $mg/cm^2$ Gd, vacuum deposited on 1.4 $mg/cm^2$ Ta, which was backed by 3.51 $mg/cm^2$ Cu. A 100 MeV $^{46}$Ti beam was provided by the Munich tandem accelerator and Coulomb excited to the $2_1^+$ state at 0.889 MeV. Deexcitation $\gamma$ rays were measured in coincidence with forward scattered carbon ions which were registered in a Si detector with the same large acceptance angle of ± 30° as used for the $^{46}$Ca experiment. The $\gamma$ rays were detected by 12.7 cm x 12.7 cm NaI(Tl) scintillators; a Ge detector at 0° was used to monitor the stability of the target via the Doppler-broadened lineshape of the 889 keV $\gamma$ line. Figs. 1 and 2 show coincident particle- and $\gamma$-spectra of the scintillator, respectively. In addition to the $\gamma$ lines from projectile Coulomb excitation there are lines attributed to excited states of $^{50}$Cr which was formed in an $\alpha$-transfer reaction. No interference with the 889 keV line of $^{46}$Ti was observed. From the measured precession angle,

$$\Phi^{exp} = 14.10(41) mrad \tag{1}$$

a $g$ factor was deduced using the empirical linear parametrization of the transient field (TF) [1],

$$g(2_1^+) = +0.512(29). \tag{2}$$

This value agrees perfectly with our previous result [1].

From the Berkeley measurement of the $2_1^+$ precession of $^{46}$Ca, $\Phi^{exp} = -8.64(1.45)$ mrad, and the present result for $^{46}$Ti, the $g$ factor ratio

$$g(^{46}Ca)/g(^{46}Ti) = -0.63(11) \tag{3}$$

was obtained which includes a ~ 3 % correction (determined with the linear or the Rutgers parametrization of the TF) accounting for small differences in the kinematics and Z-dependence of the TF. From this ratio one obtains for $^{46}$Ca a $g$ factor value,

$$g(2_1^+) = -0.312(57) \tag{4}$$

which very well agrees with the result of ref. [2].

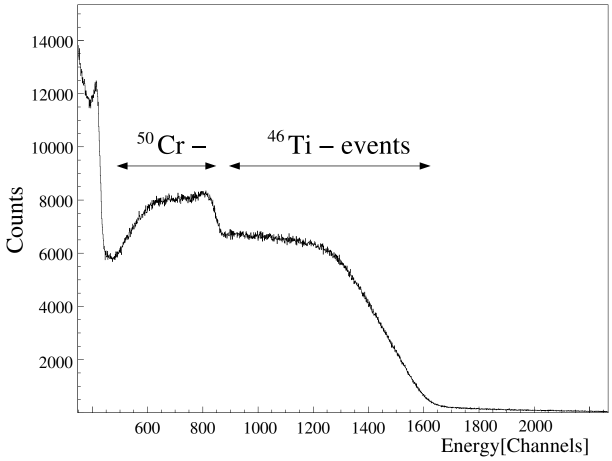


Fig. 1: Particle coincidence spectrum

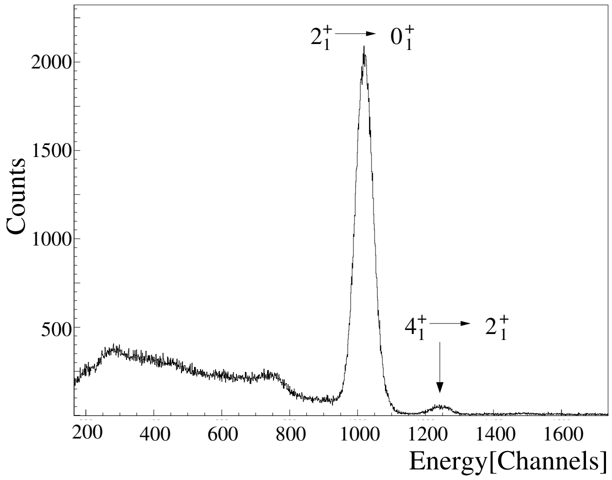


Fig. 2: $\gamma$ -coincidence spectrum gated with $^{46}$Ti-events (s. Fig. 1)

## References

[1] R. Ernst *et al.*, Phys. Rev. Lett. **84** (2000) 461
[2] K.-H. Speidel *et al.*, Phys. Rev. **C68** (2003) 061302(R)

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