First g Factor Measurement of Coulomb Excited 2_1^+ State of Radioactive ^{76}Kr Beams ◇

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This is the first g factor measurement on a radioactive nuclear beam employing projectile Coulomb excitation in inverse kinematics combined with the transient field technique [1]. The radioactive krypton isotope ^{76}Kr ($T_{1/2}$ = 14.8 h) was produced by the LBNL 88-*Inch* cyclotron in the reaction $^{74}\mathrm{Se}(\alpha, 2n)^{76}\mathrm{Kr}$ using an intense α beam of 60 MeV. The radioactive gas was driven out of the target by heating, trapped at liquid nitrogen temperature in charcoal and finally transferred to the heavy ion source of the cyclotron for acceleration to 230 MeV. An average beam intensity of $\sim 4 \cdot 10^7$ *ions/s* on target was achieved for a measuring time of ∼2 h. The whole procedure was repeated three times whereby a production run including the gas transfer to the ion source took ∼ 20 h. Data were taken for six hours which corresponded to a total of $\sim 3 \cdot 10^{11}$ Kr ions on target. This highly efficient result was only achieved after time consuming optimization of the delicate different steps of the above-mentioned procedures.

The ^{76}Kr nuclei were Coulomb excited mainly to their 2_1^+ state at 0.424 MeV with lifetime τ = 35.9 ps. Deexcitation γ rays were measured with four Ge Clover detectors in coincidence with forward scattered ^{26}Mg ions registered in a Si solar cell detector at 0°. The multi-layered target consisted of ^{26}Mg-Gd-Ta-Cu whereby the ^{76}Kr projectiles were excited in the Mg layer, the spin precession of the 2_1^+ state took place in the magnetized Gd layer and the Cu backing served as stopper. The beam itself was stopped in a moving commercial magnetic tape placed in front of the Si detector for transporting the beam radioactivity to a well shielded area. The schematics of the set-up is shown in Fig. 1.

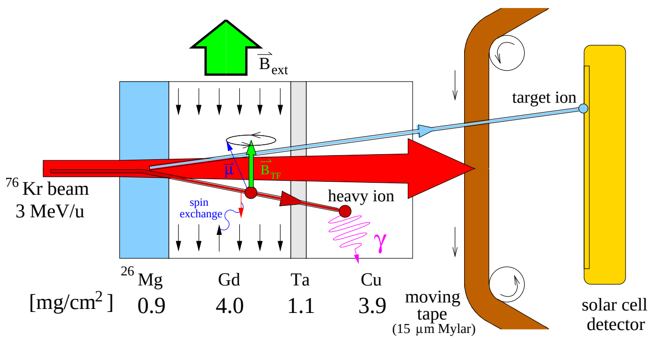

Fig. 1: Scheme of target layers, moving tape and Si detector.

Extremely clean γ coincidence spectra were obtained (see Fig. 2). In addition to the $^{76}\mathrm{Kr}(2_1^+)$ precessions, angular correlations and precessions were measured with a stable ^{78}Kr beam of high intensity and the same energy for a few hours only. In this way the unknown g factor of ^{76}Kr could be determined relative to the known value of $^{78}\mathrm{Kr}(2_1^+)$, $g = +0.43(3)$ [2]. We obtained for ^{76}Kr the preliminary result:

$$g(2_1^+) = +0.37(11) \qquad (1)$$

which can be well explained in the framework of the IBM-II model.

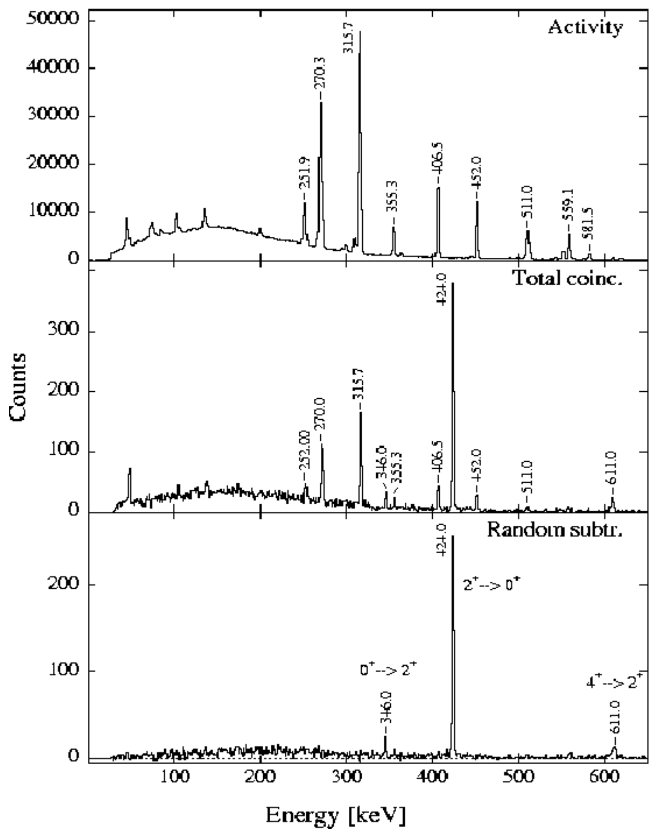

Fig. 2: γ-coincidence spectra of beam radioactivity (top), total and after random subtraction. Most of the activity lines refer to transitions in ^{76}Br

References

[1] O. Kenn *et al.*, Nucl. Instr. Meth. Phys. Res. **B171** (2000) 589
[2] T.J. Mertzemekis *et al.*, Phys. Rev. **C64** (2001) 024314

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