First Attempts to Measure the *g* Factor of the Coulomb Excited 2_1^+ State in Radioactive ^{138}Xe ◇

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In a first attempt to determine the g factor of the 2_1^+ state in ^{138}Xe we have carried out measurements at REX-ISOLDE by Coulomb excitation of a ^{138}Xe beam at the energy of 2.8 MeV/u using as a multilayered target, ^{50}Ti for projectile excitation, ferromagnetic gadolinium for transient field spin precessions, and a copper layer for stopping the excited ^{138}Xe nuclei. The de-excitation γ rays were measured with four modules of the MINIBALL detector array in coincidence with the recoiling ^{50}Ti target nuclei which were registered in an annular Si detector located at 0° relative to the beam axis.

The target was cooled to liquid nitrogen temperature and magnetized in an external field of 0.06 Tesla. For cooling a special dewar of 2.5 l volume had to be constructed to fit into the MINIBALL detector frame. A parallel plate avalanche counter was placed downstream behind the target chamber to monitor the intensity of the emerging beam. The beam of 50 μs pulse length and a repetition frequency of 3 Hz with an effective intensity of $\sim 10^4$ ions/s was steered through a 4 mm collimator onto the target and the following centre hole of the annular Si detector towards the Faraday cup. At the beginning of the experiment the particle detector was partially shielded against scattered and straggled beam ions aiming at the detection also of low-energy ^{50}Ti ions associated with large scattering angles. With this performance, however, beam ions were still elastically scattered from the target into the unshielded area of the detector causing considerable random coincidences. Only after a complete shielding of the Si detector with an Al foil true coincidences were observed. True and random γ-coincidence spectra are shown in Figs. 1 and 2, respectively.

Unfortunately, the Al foil was too thick so that a substantial amount of low-energy target ions could not be detected. Another difficulty was associated with γ radiation from the decay of the radioactive beam deposited at the collimator slits and the exit area of the target chamber (see also Fig. 2). Both places could only be insufficiently shielded so that the MINIBALL detectors were exposed to a large fraction of this radiation causing substantial background in the γ-coincidence spectra. All these unfavourable features can be significantly improved whereby a lighter target nucleus such as ^{26}Mg (instead of ^{50}Ti) is preferable due to its easier and particularly complete detection in a fully shielded Si detector. Also an elevated beam energy would be an essential improvement of the experimental conditions.

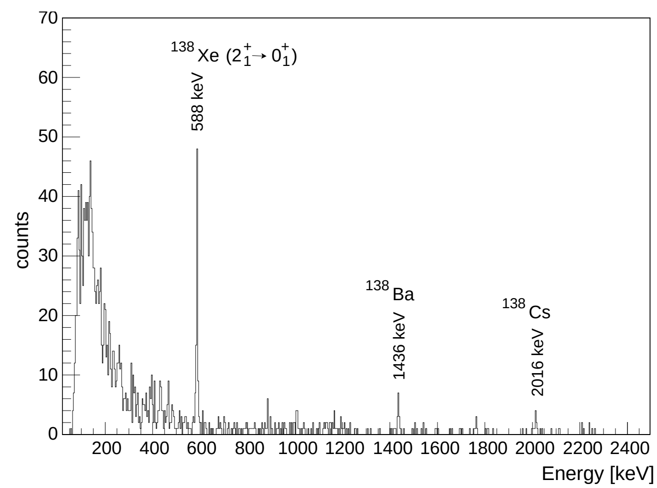

Fig. 1: True γ-coincidence spectrum of Coulomb excited ^{138}Xe beam. The prominent line refers to the ($2_1^+ \rightarrow 0_1^+$) 588 keV transition in ^{138}Xe. Two random lines are attributed to transitions in ^{138}Cs and ^{138}Ba via β-decay of ^{138}Xe (see also Fig. 2).

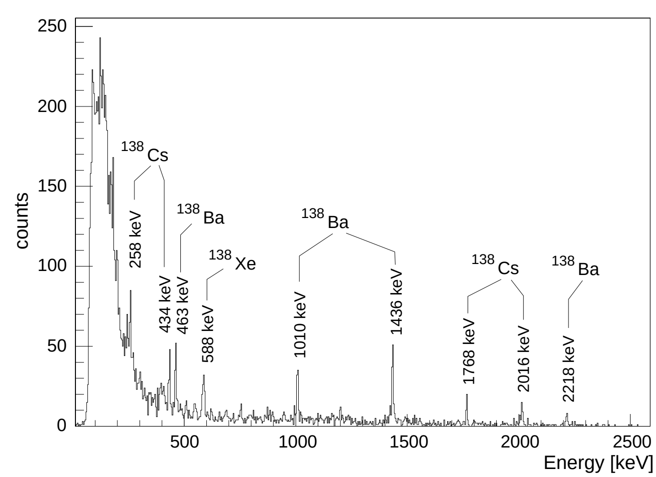

Fig. 2: Random γ-coincidence spectrum. The γ lines shown refer to transitions in ^{138}Cs and ^{138}Ba, both produced via β-decay of ^{138}Xe.

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