Low-Level Structure of ^{70}Ge from Lifetime and g-Factor Measurements Following α-Transfer to a ^{66}Zn Ion Beam ◇

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The g factor of the 2_1^+ state in ^{70}Ge has been remeasured and the lifetimes of the 2_1^+, 2_2^+, 4_1^+ and the 3_1^- states were redetermined using the techniques of transient magnetic fields and Doppler-Shift-Attenuation, respectively [1]. The states of interest were populated in an α-transfer reaction to a beam of 180 MeV ^{66}Zn ions in collisions with natural carbon. The multilayered target consisted of carbon deposited on Gd backed by a Cu layer in which the excited ^{70}Ge nuclei were stopped. The isotopically pure ^{66}Zn ion beam was provided in sufficient intensity by the Munich tandem accelerator. The de-excitation γ rays were detected by four NaI(Tl) scintillators and a Ge detector in coincidence with the α particles emitted in the decay of the residual ^{8}Be nuclei which were registered in a 0° Si detector (see also Fig. 1). A Ta foil between the particle detector and the target served as a beam stopper. The Ge detector was placed at 0° for monitoring the Doppler-broadened lineshapes reflecting the nuclear lifetimes. The g factor results and the B($E2$) values deduced from the measured lifetimes were compared with large-scale full fp shell model calculations (Table 1). These were carried with the computer programs OXBASH [2] and ANTOINE [3] using the most commonly applied effective interactions for fp shell nuclei like FPD6 [4] and GXPF1 [5]. No single interaction could account for the complete low-energy structure of ^{70}Ge, quite in contrast to similar results for ^{68}Ge [6]. Another important result of the analysis of the 2_1^+ precession was that the g factor of the feeding 4_1^+ state might be similar to the measured g value of isotonic ^{68}Zn which surprisingly has a negative sign.

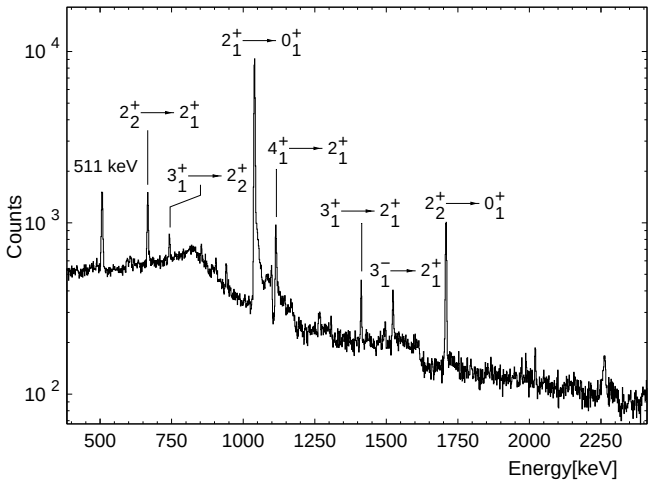

Fig. 1: γ-coincidence spectrum of the 0° Ge detector. The assigned γ lines refer to the level scheme of ^{70}Ge and the Doppler-broadened lineshapes reflect the nuclear lifetimes.

References

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Quantity	Experimental	KB3	FPD6	GXPF1	GXPF1A
$E(2_1^+)$[MeV]	1.039	1.470	1.050	1.337	1.097
$E(2_2^+)$[MeV]	1.707	2.745	2.229	2.387	1.976
$E(0_2^+)$[MeV]	1.212	3.926	2.416	2.301	1.909
$E(2_3^+)$[MeV]	2.156	4.127	2.745	2.661	2.339
$E(4_1^+)$[MeV]	2.153	2.413	2.218	2.256	2.093
$g(2_1^+)$	$+0.47(3)^a$ $+0.43(12)$	+0.528	+0.769	+0.397	+0.343
$g(2_2^+)$	+0.4(6)	+0.678	+0.880	+0.745	+0.896
$B(E2; 0_1^+ \to 2_1^+)[e^2b^2]$	0.179(3)	0.0501	0.1776	0.0789	0.0673
$B(E2; 0_1^+ \to 2_2^+)[e^2b^2]$	0.0047(8)	0.0138	0.0110	0.0022	0.0081
$B(E2; 2_1^+ \to 2_2^+)[e^2b^2]$	0.118(21)	0.0115	0.0394	0.0105	0.0067
$B(E2; 2_1^+ \to 4_1^+)[e^2b^2]$	0.078(14)	0.0135	0.0665	0.0234	0.0216

[a] [7]

Table 1: Experimental results in comparison to full fp shell model calculations using different effective interactions.

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