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First calculation of the $\gamma\gamma$-decay width of a nuclear 2_1^+ state: The case of ^{48}Ca

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In Ref. [1], the $\gamma\gamma$-decay of a nuclear transition in competition with an allowed γ-decay has been discovered. This is the observation of the $\gamma\gamma$-decay of the first excited $J^\pi = 11/2^-$ state of ^{137}Ba directly competing with an allowed γ-decay to the $J^\pi = 3/2^+$ ground state.The branching ratio of the competitive $\gamma\gamma$-decay of the $11/2^-$ isomer of the odd-even nucleus ^{137}Ba to the ground state relative to its single γ-decay was determined to be $(2.05 \pm 0.37) \times 10^{-6}$. This discovery has very recently been confirmed and the data were made more precise, in particular with respect to the contributing multipolarities [2].
The competitive double-γ decay of the 2_1^+ state of an even-even spherical nucleus is studied for the first time. The coupling between one-, two- and three-phonon terms in the wave functions of excited states is taken into account within the microscopic model based on the Skyrme energy density functional. The approach enables one to perform the calculations in very large configurational spaces [3,4]. We estimate the generalized electric dipole polarizabilities involved in the $\gamma\gamma/\gamma$ decay process and make a prediction for the branching ratio of the competitive $\gamma\gamma$-decay relative to its single γ-decay calculated to be 3×10^{-8} for the case of ^{48}Ca [5].

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