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The double gamma decay of the quadrupole state of spherical nuclei

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The γγ-decay reactions are formally analogous to neutrinoless double-β decay processes where in the latter two β-particles and in the former two γ-quanta appear in the final state and share the total energy of the nuclear transition. This paper reports on the situation, in which the γγ-decay of the low-energy quadrupole state occurs in a nuclear transition which could proceed by a single-γ decay in competition. To describe the γγ-decay, a formalism relates the electromagnetic interaction up to second order in the electromagnetic operators and two-quantum processes in atomic nuclei. The coupling between one-, two- and three-phonon terms in the wave functions of excited nuclear states is taken into account within the microscopic model based on the Skyrme energy density functional. It is shown that the γγ-decay width is sensitive to the interaction between one- and two-phonon configurations. The maximal branching ratio of the competitive γγ-decay relative to its single γ-decay is predicted as 10^{-8}. This prediction can be tested experimentally.

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