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Mössbauer spectra of ferromagnets in radio-frequency magnetic field

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We studied the Mössbauer absorption and forward scattering (FS) spectra of soft ferromagnets, exposed to a radio-frequency (rf) magnetic field. It is done in the framework of the quantum electrodynamics, taking account of periodical reversals of the crystal magnetization and respectively of the magnetic field at the nuclei [1- 4]. Transient effects caused by single reversal of the magnetic field are carefully studied [1]. In particular, it is shown that the reversal is followed by the attenuating oscillations of the total cross section, as well as by fall down of the absorption. The Zeeman magnetic splitting of nuclear quasi-levels is predicted and experimentally observed, when the nucleus is simultaneously subject to both rf and constant magnetic fields [2].

The multiple scattering theory is developed [3] for γ-quanta, passing through a crystal of arbitrary thickness in the rf field. It is found that the γ-photon, being absorbed and then emitted by the nuclear exciton can exchange with the rf field only by couples of the rf photons. As a result, the corresponding FS spectra consist of equidistant lines spaced by twice the frequency Ω of the rf field in contrast to the absorption spectra with satellites spaced by Ω. In addition, the Mössbauer absorption and FS spectra are measured for the weak ferromagnet $FeBO_3$ in the rf field, which are well reproduced by our calculations. Besides, we investigated the role of stochastic processes, leading to dispersion of the reversal moments (some preliminary results are given in [4]).

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