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MÖSSBAUER FORWARD SCATTERING SPECTRA OF FERROMAGNETS IN RADIO-FREQUENCY MAGNETIC FIELD

The transmission of Mössbauer radiation through a thick ferromagnetic crystal, subjected to the radio-frequency (rf) magnetic field, is studied. A quantum-mechanical dynamical scattering theory is developed, taking into account both the periodical reversals of the magnetic field at the nuclei and their coherent vibrations. The Mössbauer forward scattering (FS) spectra of the weak ferromagnet $FeBO_3$ exposed to the rf field are measured. It is discovered that the coherent gamma wave in the crystal, interacting with Mössbauer nuclei, absorbs or emits only couples of the rf photons. As a result, the FS spectra consist of equidistant lines spaced by twice the frequency of the rf field in contrast to the absorption spectra. Our experimental data and calculations well agree if we assume that the hyperfine field at the nuclei in $FeBO_3$ periodically reverses and there are no coherent vibrations.

Keywords: Mössbauer spectroscopy, forward scattering spectra, iron borate, radio-frequency magnetic field.