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Nuclear resonant scattering of synchrotron radiation in gamma optical paramagnetic integer-spin media

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Abstract

Nuclear forward scattering of synchrotron radiation (SR) is theoretically modeled in multilevel gamma optical paramagnetic media with the effective integer spin (5=1, 2) affected by the electron spin fluctuations in the unfilled electronic shell of the Mössbauer ion 57Fe4+(2+). The equilibrium fluctuations of the effective spin generate a variation in the time phase coherence in the total amplitude of the resonant forward scattering of the SR pulse gamma quanta by the ensemble of the Mössbauer nuclei. A resulting specific temperature dependence of the resonant response of the gamma optical paramagnetic medium is observed.