X-Ray Dynamical Diffraction 'Third Order Nonlinear Renninger Effect'

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Abstract : Nowadays X-ray nonlinear diffraction and nonlinear effects are investigated due to the presence of the third generation synchrotron sources and XFELs. X-ray third order nonlinear dynamical diffraction is considered as well. Using the nonlinear model of the usual visible light optics the third-order nonlinear Takagi's equations for monochromatic waves and the third-order nonlinear time-dependent dynamical diffraction equations for X-ray pulses are obtained by the author in previous papers. The obtained equations show, that even if the Fourier-coefficients of the linear and the third order nonlinear susceptibilities are zero (forbidden reflection), the dynamical diffraction in the nonlinear case is related to the presence in the nonlinear equations the terms proportional to the zero order and the second order nonzero Fourier coefficients of the third order nonlinear susceptibility. Thus, in the third order nonlinear Bragg diffraction case a nonlinear analogue of the well-known Renninger effect takes place. In this work, the 'third order nonlinear Renninger effect' is considered theoretically.

Keywords : Bragg diffraction, nonlinear Takagi's equations, nonlinear Renninger effect, third order nonlinearity

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