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Superposition of waves in interference field and channeling radiation

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Spectral features of proton channeling radiation, revealed by the interference of two modes of circular waves with the same frequency and amplitude, are studied.
The beam modulation is resolved using the realistic Monte Carlo simulation by taking into account the degree of spatial coherence and longitudinal coherence length, multiple scattering effect, electron energy loss, emission angles, and polarization factors. The resulting interference patterns are strongly affected by the superposition of circular waves that are associated to distinct wave phases difference, produced at different points transverse and longitudinal to the direction of particle propagation in crystal channel. The spherical wavefronts are induced by atomic vibrations considering individual lattice atoms as one dimensional harmonic oscillators or point sources, trough binary collision process.
Our investigation shows that more robust stability of coherence of the beam of perfectly superposed waves in interference field, as well as controlled channeling radiation, could enable probing of time resolved processes with unprecedented resolution, since significant improvements of stability and reproducibility may be utilized for adequate bunching and modulation for coherent emission, when the modulated density of energetic particles approaches the wavelength of the channeling radiation.

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