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Coherent X-ray radiation generated by divergent beam of relativistic electrons in composite structure "amorphous layer - vacuum - single crystal"

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The dynamic theory of coherent X-ray radiation generated by a beam of relativistic electrons in three-layer structure consisted of amorphous layer, vacuum (air) layer and a single crystal has been developed. The expressions for spectral-angular density of diffracted transition radiation (DTR), parametric X-ray radiation (PXR) and their interference term have been derived within the framework of two-wave approximation of dynamic theory of diffraction of X-ray in single-crystal. The derived expression for spectral-angular characteristics of DTR contain the summands defining the contributions of transition radiation (TR) from amorphous layer, TR from the front boundary of single-crystal layer and their interference term to spectral-angular density of DTR. The dependence of the characteristics of DTR in such a structure on the beam divergence has been studied. The considerable influence of the beam divergence on the interference of Transition radiation (TR) from amorphous layer and front boundary of the single -crystal layer has been shown. It has been shown also that a slight change in thicknesses of the layers do not lead to change of character of interference in a vicinity of Bragg frequency (to transition from constructive to destructive interference).
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Primary author: Prof. BLAZHEVICH, Sergey (Belgorod State University)

Co-authors: Prof. NOSKOV, Anton (Belgorod State University); ZAGORODNYUK, Roman (Belgorod state university); NEMZEV, Sergey (Belgorod state university)

Presenter: Prof. NOSKOV, Anton (Belgorod State University)

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