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Tunable Optical Radiation Formed in Crystalline Undulator

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The problem of optical radiation produced by a bunch of relativistic positrons channeled to a crystalline undulator (CU) is considered. Taking into account the polarization of the crystal medium, an energy threshold takes place to form the radiation. If the energy of the bunch is above the threshold, the radiation is created in a limited frequency range. Both soft and hard boundary photons exist and are emitted at a zero angle due to the polarization of the medium. In the case where the ratio between bunch's and threshold energies is much greater than unity, the energy of the boundary soft photons depends only on the characteristic parameters (spatial period, amplitude) of the crystalline sinusoidal undulator and can be tuned to the optical range. It is shown that it is possible to obtain a directed optical beam in the "water window" range. Such photon beams have important applications in medicine and biological research.

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