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Generation of Cherenkov radiation in the soft x-ray region by 10-MeV electron accelerator

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Abstract

Cherenkov radiation is generated when relativistic charged particles move in a medium with refractive index larger than unity. Although, the refractive index is generally smaller than unity in X-ray region, in the vicinity of atomic absorption edges, the refractive index may exceed unity and Cherenkov radiation can be generated in soft X-ray region with a narrow band width. In this paper, the spectral-angular distribution of X-ray Cherenkov Radiation (XCR) and its properties are analyzed. It is shown that, by using electron accelerators which can produce 10 MeV electrons, with average current density 20 mA/mm^2, and choosing different μm-thick foils, one can produce soft X-ray Cherenkov radiation source with intensity about 10^{-4} ph/el, and X-ray photon energy from 50 eV up to 1 keV.–Some unique properties of XCR, such as narrow band width and high brightness, make XCR a novel soft X-ray source for applications in soft X-ray microscopy, photoelectron spectroscopy, analysis of trace elements and other research areas.

Keywords: electron accelerator, Cherenkov radiation, soft X-rays

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