

Betatron radiation from accelerated electrons: an analytical study

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X-rays production through betatron radiation emission from electron bunches is a valuable resource for several research fields. The EuAPS (EuPRAXIA Advanced Photon Sources) project, within the framework of the EuPRAXIA project, aims to provide 1-10 keV photons (soft X-rays) using a compact plasma based system designed to exploit self-injection processes that occur in highly nonlinear laser-plasma interaction (LWFA) to drive electron betatronic oscillations. While numerical analysis is being pursued, we also aim to gain insights into the emission process through an analytical approach. By generalizing well-known results (I. Kostyukov, S. Kiselev, and A. Pukhov), we derive a comprehensive analytical expression for the emission spectrum in solid angle for single particles subjected to constant longitudinal force and linear transverse force moving in a planar trajectory. Model's approximations are presented, along with intensity plots on the detector and trends in critical frequency for some plasma wiggler strength and longitudinal force values.

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