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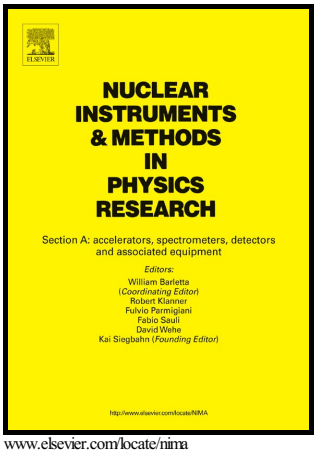

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Generation of high harmonic free electron laser with phase-merging effect

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Abstract

An easy-to-implement scheme is proposed to produce the longitudinal electron bunch density modulation with phase-merging phenomenon. In this scheme an electron bunch is firstly transversely dispersed in a modified dog-leg to generate the exact dependence of electron energy on the transverse position, then it is modulated in a normal modulator. After travelling through a modified chicane with specially designed transfer matrix elements, the density modulation with phase-merging effect is generated which contains high harmonic components of the seed laser. We present theoretical analysis and numerical simulations for seeded soft x-ray free-electron laser. The results demonstrate that this technique can significantly enhance the frequency up-conversion efficiency and allow a seeded FEL operating at very high harmonics.

Keywords: free-electron laser, harmonic generation, phase-merging effect, bunching factor

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