Joint DESY and University of Hamburg Accelerator Physics Seminar

Friday, February 04, 2005

(14:00 in Room 459/30b)

Modeling of X–Ray Free–Electron Lasers

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Abstract

An electron beam, injected into the periodic field of an undulator magnet, can drive a Free–Electron Laser (FEL) and thus overcomes the wavelength restriction of conventional quantum lasers. The start–up signal for this freely tunable radiation source is supplied by the spontaneous radiation within the undulator. Based on the successful demonstration of these self–amplified spontaneous emission free–electron lasers (SASE FELs) at longer wavelengths, two X–ray FELs — LCLS at SLAC and TESLA at DESY — are currently under construction. The constraints on the driving electron beam and the undulator field are more stringent in the X–ray regime. In addition new effects, not seen at longer wavelengths, can degrade the FEL perfomance. To predict the output characteristics of the SASE FELs the analytical model has to be supplemented with highly detailed numerical simulations. This presentation reports on the current status of the modeling effort of the LCLS X–ray FEL. Beside the numerical challenges of these start–to–end simulations the emphasis is put on one of the most degrading effects — the wakefield within the undulator beam pipe and their partial compensation with a slight taper of the undulator field.

NOTE THE UNUSUAL DATE AND TIME

D.P.Barber (MPY), J.Rossbach (Univ. HH) and M.Vogt (MPY).

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