The Beams and Applications Seminar Series

An Analysis of Smith-Purcell Free-Electron Lasers

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ASD/ANL

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Host: K.-J. Kim, ASD

An electron beam traveling close and parallel to a metallic reflection grating gives off polarized electromagnetic radiation known as Smith-Purcell radiation. Smith-Purcell Free-electron lasers (SP-FELs) based on this effect are recently seen as a possible compact source of coherent tunable THz radiation. SP-FELs can operate as a backward wave oscillator, obviating the need for feedback mirrors for oscillation. In this talk, we discuss a self-consistent theory of SP-FELs that we have recently developed. In the linear approximation, we show that the optical power grows exponentially if the current is larger than a certain value, the start current. We set up the nonlinear, time-dependent Maxwell-Lorentz equations like conventional FELs and discuss the computer code developed to solve these equations numerically. Results of our numerical calculation compare well with the analytic calculation in the linear regime and show the saturation behavior in the nonlinear regime. We discuss several ways of out-coupling this power. Examples of SP-FELs for high power Terahertz radiation are discussed.

For more information visit

http://www.aps.anl.gov/asd/physics/seminar.html

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