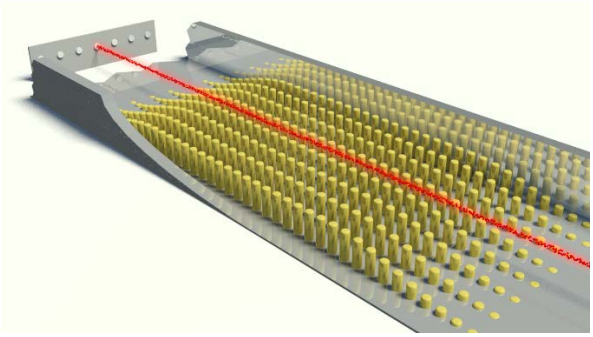
Chairs: Laser Physics and Nonlinear Optics

Gain in a photonic free-electron laser

Short project description:

In a photonic free-electron laser one or more electron beams stream through a photonic crystal (see figure). The function of the crystal is to slow down the phase velocity of a co-propagating electromagnetic wave to just below the electron velocity to enable generation of Cherenkov radiation. Coherent radiation is generated as a result of the feedback of the radiation wave on the electrons and requires the wave to have a nonzero longitudinal electric field component.



One of the attractive features of this concept is the possibility to stream more than one electron beam through the photonic crystal. This has two major advantages, (i) it allows to scale the output power of the device and (ii) it relaxes the requirements on the electron generation (electron gun) and electron beam transport through these devices.

In this assignment you will study a photonic FEL configuration with a two dimensional array of electron beams streaming through the crystal. You will calculate the eigenmodes of the photonic crystal, identify modes that can couple to the electron beams and determine the tuning range of the device when it is pumped by low energy (~10 keV) electrons. Finally, you will set up a particle-in- cell model that will allow you to calculate gain and saturated output power.

Supervision	e-mail	tel.	office	project room
Tutor: Peter van der Slot	p.j.m.vanderslot@utwente.nl	3967	ME127	
Teacher: Peter van der Slot	p.j.m.vanderslot@utwente.nl	3967	ME127	