CFEL SCIENCE

# SEMINAR

**07th February 2012 - 10:30 a.m.**
Building 222, room 013

---

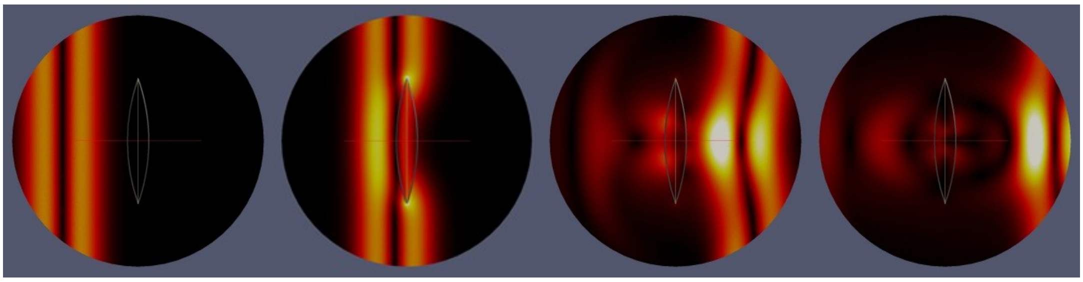

## Arya Fallahi

Large Research Facilities Department (GFA)
Paul Scherrer Institut, Villigen, Switzerland


## Efficient Maxwell solvers: from electron guns to metamaterials


By the emergence of novel fabrication techniques in nanotechnology, realization of various complex and miniaturized structures became feasible in nanometer scales. Specifically, excitation of surface plasmon polaritons may be helpful for achieving high-density electron beams, which are produced by the electron guns based on the field emitter concept. To properly design and optimize the nanostructures for any application, a Maxwell solver is required, which can robustly and efficiently model different configurations. First, a recently developed dual-field, fully explicit Element Level Time Domain (ELTD) method for solving the Maxwell equations on unstructured tetrahedral grids will be presented. The main principles of the ELTD method are discussed and its applicability for solving 3-dimensional electromagnetic problems is investigated. Then, efficient procedures for mesh truncation in time-domain simulation using ELTD are focused. An accurate and versatile method based on boundary integrals is introduced, which leads to robust mesh truncation in solving open-region scattering problems.

In the second part, the analysis and design of metamaterials are targeted. The complex configurations of these devices always prevent their accurate modeling for predicting the overall performance. Therefore, solving the Maxwell equations for such structures is always a challenging task. In this contribution, fast and precise numerical routines for analysis of planar metal-dielectric metamaterials will be introduced. These methods are used in tandem with novel optimization algorithms to design radar absorbers which are applied for protecting living beings from electromagnetic radiation. Based on some innovations a radar absorber is reported which, to the best of our knowledge, relative to the operation wavelength was the thinnest absorber ever fabricated.

Host: Franz X. Kärtner, CFEL UX Seminar