EUPROMETA – 30th Doctoral School on Metamaterials,
11-15 April, 2016 – Karlsruhe, German

Computational Photonics
School Tentative Program

Karlsruher Institut für Technologie

	Expert	Content (selected keywords)
1	**Dr. Sven Burger** (JCMwave, Berlin)	• Presentation and extended hands-on training on JCMsuite, a program that solves Maxwell's equations with the finite element method. • Along with the basics of the finite-element methods, the participants will learn how to specifically apply the program to study a larger number of different problems in contemporary research.
2	**Dr. Frank Demming-Janssen** (CST-AG)	• Presentation and extended hands-on training on the CST MICROWAVE STUDIO, a program that solves Maxwell's equations with the finite integration technique. • Along with the basics of the finite integration technique, the participants will learn how to specifically apply the program to study a larger number of different problems in contemporary research. Examples for the application are taken form the field of plasmonics and integrated photonics; where finite-element methods and the technique of method-of-moments is used to solve Maxwell's equations.
3	**Prof. Ulrich Hohenester** (University of Graz, Austria)	• Basics of integral methods are discussed. The method is useful if isolated objects are studied. They can, however, be also embedded in a more complicated optical environment (e.g. on a substrate or in a stratified media). • Specifically, for homogenous objects, the volume integral can be recast to a surface integral equation whose solution is found with the boundary element method. A detailed overview of this technique is given. • Hands-on training on the MATLAB toolbox "MNPBEM". It implements routines to solve boundary integral equations. The original purpose of the toolbox was to study metallic nanoparticles, but it can be used for much more.

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4	**Prof. Carsten Rockstuhl** (Karlsruhe Institute of Technology, Germany)	• Basics and overview of those computational methods that are not covered by the other colleagues. • This comprises methods to solve dispersion relation of waveguides using the finite-difference scheme, techniques to solve the scattering from cylindrical or spherical particles, and beam propagation methods.
5	**Jun.-Prof. Thomas Weiss** (University of Stuttgart, Germany)	• Basics and applications of plane wave expansion methods are discussed. These methods are applicable whenever periodic structures are considered. • It is shown how the method can be used to calculate the band-structure of periodic photonic materials in different dimensions, e.g. of photonic crystals, coupled waveguides, or metamaterials. • Extensions to the method are presented, such as how to study diffraction from periodic structures, e.g. gratings or metasurfaces.
6	**Prof. Richard W. Ziolkowski** (The University of Arizona, USA)	• Basics of the Finite-Difference Time-Domain (FDTD) method, a general purpose method to solve Maxwell's equations by a proper discreatization in space and time. • The method itself is quite intuitive. However, many details need to be considered to actually make a simulation. They concern boundary conditions, implementation of material properties, and the integration of sources are discussed. • Applications of the finite-difference time-domain method are given with emphasis on topics of current research interests.