

## HL 39 Symposium Photonic metamaterials

Time: Thursday 11:00–13:00

Room: HSZ 01

### Keynote Talk

HL 39.1 Thu 11:00 HSZ 01

**Magnetoinductive waves in magnetic metamaterials** —  
 •EKATERINA SHAMONINA — Department of Physics, University of Osnabrück, D-49069 Osnabrück, Germany

Magnetoinductive waves have arisen as a by-product of the research on negative refraction and subwavelength imaging in metamaterials. Metamaterials are artificial structures comprising arrays of small resonant elements. Contrary to photonic band gap (PBG) materials, where the periodicity of the structure is comparable to the wavelength, in metamaterials both the size and the distance between the elements are much smaller than the wavelength. Consequently, the electromagnetic response of PBG materials is due to Bragg diffraction phenomena, whereas in metamaterials subwavelength phenomena are responsible for their unusual electromagnetic properties. In particular, magnetic metamaterial elements such as Split Ring Resonators are capable of propagating not only transverse electromagnetic waves but also waves due to their magnetic coupling and their resonant nature, known now as magnetoinductive waves, opening up several avenues of novel applications.

In the present talk the birth of the subject of metamaterials, including many early contributions, is briefly reviewed and the properties of magnetoinductive waves are discussed with particular reference to their dispersion characteristics, excitation and applications such as near field imaging, sensing and manipulation including waveguides, waveguide components, flux concentrators and detectors for magnetic resonance imaging.

### Keynote Talk

HL 39.2 Thu 11:30 HSZ 01

**Photonic metamaterials: Magnetism and negative index of refraction at optical frequencies** — •STEFAN LINDEN<sup>1</sup>, MARTIN WEGENER<sup>1,2</sup>, CHRISTIAN ENKRICH<sup>2</sup>, MATTHIAS W. KLEIN<sup>2</sup>, MANUEL DECKER<sup>2</sup>, GUNNAR DOLLING<sup>2</sup>, NILS FETH<sup>2</sup>, COSTAS M. SOUKOULIS<sup>3</sup>, SVEN BURGER<sup>4</sup>, and FRANK SCHMIDT<sup>4</sup> — <sup>1</sup>Institut für Nanotechnologie, Forschungszentrum Karlsruhe, Germany — <sup>2</sup>Institut für Angewandte Physik, Universität Karlsruhe (TH), Germany — <sup>3</sup>Ames Laboratory and Department of Physics and Astronomy, Iowa State University, U.S.A. — <sup>4</sup>Zuse Institut Berlin, Germany

We review our recent work on photonic metamaterials, comprising “artificial magnetism” in the near-infrared spectral region as well as the fabrication of square-centimeter area structures. Very recent experimental results indicate the possibility of low-loss negative-index metamaterials at  $1.5\mu\text{m}$  wavelength.

### Keynote Talk

HL 39.3 Thu 12:00 HSZ 01

**Metamaterials: Going Optical** — •VLADIMIR SHALAEV — School of Electrical and Computer Engineering, Purdue University, West Lafayette, IN 47907, USA

In this talk I'll review our recent theoretical and experimental studies on metamaterials with a negative refractive index in the optical range.

### Keynote Talk

HL 39.4 Thu 12:30 HSZ 01

**Negative refraction without absorption in the optical regime** —  
 •MICHAEL FLEISCHHAUER — Fachbereich Physik, Technische Universität Kaiserslautern, 67763 Kaiserslautern

Negative refraction can lead to a number of interesting effects and applications in quantum electrodynamics and laser physics. Among them are strong radiative coupling between atoms over mesoscopic distances, the modified Purcell effect or the possibility for zero-optical length resonators. These effects require however low-loss negative refraction in the optical regime which has not been achieved so far. After a short review of QED effects in negative-index materials I will discuss a theoretical proposal for resonantly enhanced chirality and negative refraction without absorption based on electromagnetically induced transparency.