species experiments with ultracold atoms. In this context optical lattices are expected to enhance the lifetime of weakly bound Feshbach molecules considerably by protective enclosure of single molecules on single lattice sites. However, the achievement of this configuration necessitates appropriate loading of the atomic clouds into the lattice before association.

In our setup we cool fermionic ^{40}K with bosonic ^{87}Rb sympathetically, reaching simultaneous quantum degeneracy with about $2 \cdot 10^5$ atoms per species. We load this mixture into a blue-detuned optical lattice and adjust the external confinement independently with additional red-detuned laser beams. This allows for the creation of an almost homogeneous lattice potential. Together with tuneable interspecies interactions our setup permits controlled loading - suitable for the creation of molecules in the lattice.

Q 23: Photonik II

Zeit: Dienstag 16:30–18:00 Raum: 2B/C

Q 23.1 Di 16:30 2B/C

Limits for kinematical diffraction of visible light from three dimensional photonic crystals — •Marcel Roth[1], Ullrich Pietsch[1], Georg von Freymann[2], and Martin Wegener[2] — [1]Institute of solid state physics, University of Siegen, 57072 Siegen, Germany — [2]Institute of applied physics, University of Karlsruhe, 76131 Karlsruhe, Germany

For the majority of research studies with photonic crystal the existence and spectral width of a photonic band gap are of main interest. Light diffraction experiments with wavelengths in the visible and near infrared spectrum are predominantly used to verify the structural quality of the crystals.
The usage of photonic crystals as purely diffractive elements in optical detectors is a relatively new idea. Due to the three dimensional periodic structuring an incoming white beam is spatially seperated into symmetry equivalent coloured spots that can be used for object recognition.
All geometrical aspects can be understood in the framework of the von Laue equations. On the other side an analytical description for diffraction efficiencies is restricted to the case of kinematical scattering well known from the x-ray diffraction. This approximation is typically not valid for most photonic crystals because of large dielectric contrasts.
In this talk we present experimental investigation and results of numerical calculations based on Maxwell equations which show that the limit for kinematical diffraction at photonic crystals is estimated for a relative dielectric mismatch of about 5%.

Q 23.2 Di 16:45 2B/C

Optical properties of three-dimensional photonic quasicrystals and their periodic approximants — •Alexandra Ledermann[1], Costanza Toninelli[2], Diederik S. Wiersma[2], Martin Wegener[1], and Georg von Freymann[1] — [1]Institut für Nanotechnologie, Forschungszentrum Karlsruhe in der Helmholtz-Gemeinschaft, DFG-Center for Functional Nanostructures (CFN) and Institut für Angewandte Physik, Universität Karlsruhe (TH) — [2]European Laboratory for Nonlinear Spectroscopy (LENS) and INFM, Firence

Quasicrystals (QC) represent a class of solids which lack translational symmetry, but exhibit perfect long-range order and reveal well-defined rotational symmetries, not necessarily consistent with periodicity.

Using direct laser writing [1] we fabricate three-dimensional icosahedral SU-8 photonic QCs of high quality [2] and their so-called periodic approximants [3]. The optical properties of both QC and approximants are studied experimentally and show good agreement with corresponding simulations for the approximants. Time-resolved pulse propagation studies reveal the strongly diffracting character of QC which causes a strong delay and pulse reshaping during the propagation.

This work is an important step towards a better understanding of the effects of quasiperiodicity.

[1] M. Deubel et al., Nature Materials, 3, 444 (2004).
[2] A. Ledermann et al., Nature Materials, 5, 942 (2006).
[3] C. Janot, Quasicrystals- A Primer, Clarendon, Oxford (1992).

Q 23.3 Di 17:00 2B/C

Photonic Metamaterials by Direct Laser Writing and Silver Chemical Vapor Deposition — •Christine Plet[1], Michael Rill[1], Michael Thiel[1], Stefan Linden[2], Georg von Freymann[2], and Martin Wegener[1,2] — [1]Institut für Angewandte Physik, Universität Karlsruhe (TH), 76128 Karlsruhe, Germany — [2]Institut für Nanotechnologie, Forschungszentrum Karlsruhe in der Helmholtz-Gemeinschaft, 76021 Karlsruhe, Germany

Metamaterials are man-made composite structures composed of metallic sub-wavelength scale functional building blocks that are densely packed into an effective material [1,2]. This approach especially allows for artificial magnetism at elevated frequencies.

We fabricate planar magnetic photonic metamaterials via direct laser writing [3] and silver chemical vapor deposition, an approach, which is also suitable for three-dimensional structures.

When retrieving effective metamaterial parameters for normal incidence of light, one has to be cautious because the fabricated structures are non-centrosymmetric. Thus, a description in terms of just electric permittivity ε and magnetic permeability μ is fundamentally not possible. Here, we follow the bi-anisotropic retrieval described in Ref. [4].
[1] V.M. Shalaev, Nature Phot. **1**, 41 (2006)
[2] C.M. Soukoulis, S. Linden, and M. Wegener, Science **315**, 47 (2007)
[3] see, e.g., http://www.nanoscribe.de
[4] X. Chen, B. Wu, J. Kong, and T. Grzegorczyk, Phys. Rev. E **71**, 046610 (2005)

Q 23.4 Di 17:15 2B/C

3D analysis of polarization singularities in Laser speckle — •Florian Flossmann[1], Kevin OHolleran[1], Miles J. Padgett[1], and Mark R. Dennis[2] — [1]University of Glasgow, United Kingdom, Department of Physics and Astronomy — [2]University of Bristol, United Kingdom, H.H. Wills Physics Laboratory

Singularities of the polarization of light are the vectorial analogies to optical vortices (phase singularities) in scalar optics. Two types are known: L lines of linear polarization and C points of circular polarization, the latter can be further devided into lemon, star and monstar type C points. In 3D, they occur as L surfaces and C lines. Laser speckle fields, as a random superposition of coherent plane waves, form the most natural interference pattern and are therefore an obvious place to look for generic optical singularities "in the wild". Following our earlier work on the 3D topology of phase singularity lines in laser speckle (O'Holleran, submitted PRL) and on the natural unfolding of optical vortices into generic polarization singularities (Flossmann,PRL 2005), we investigate both experimentally and numerically the singularities of polarization (C lines and L surfaces) in a random vector field as found in polarized laser speckle. With that we present the (to our knowledge) very first truely 3 dimensional visualization of polarization singularities in optics from experimentally obtained data. We show for example, how C loops always consist of lemon, star and monstar type C points and perform a statistical analysis of the ratios of those types per line length.

Q 23.5 Di 17:30 2B/C

Controlled coupling of emitters to SiN photonic crystal cavities — •Johannes Stingl[1], Michael Barth[1], Josef Kouba[2], Bernd Löchel[2], and Oliver Benson[1] — [1]Nano-Optik, Institut für Physik, Humboldt-Universität zu Berlin, Hausvogteiplatz 5-7, 10117 Berlin — [2]Anwenderzentrum für Mikrotechnik, BESSY GmbH, Albert-Einstein-Str. 15, 12489 Berlin

The controlled coupling of emitters to photonic crystal (PC) cavities is a crucial issue for future applications of integrated PC structures. Here we present a versatile approach to this problem based on the manipulation of nanoscopic particles on the PC surface by scanning probe techniques. This method allows a deterministic and reversible coupling of one or more light emitting particles to the cavities after the fabrication of the samples. We apply this approach to couple diamond nanocrystals containing NV color centers to SiN PC cavities. These cavities operate in the visible wavelength range between 550 nm and 800 nm and are therefore ideally suited to manipulate the emission properties of a broad variety of emitters in the visible. Despite the relatively small refractive index of SiN (n = 2.0) the cavity quality factors