

# Parameter Measurements, Extraction & Interpretation: Photonic Metamaterials

- Frequency range: 100 THz – 400 THz  
→ Drude metals, additional damping due to interfaces
- Wavelength / lattice constant  $\approx 3 \dots 7$   
→ Effective medium approach?
- Photonic Metamaterial are often anisotropic  
→ Effective parameters are tensors
- Most experiments: “Metalayers” instead of “Metamaterials” → “Bulk” properties?
- Characterization of “Photonic Atoms” / Metamaterials

# Characterization of Individual “Photonic Atoms”

- Modulation spectroscopy: Absolute measurement of the extinction cross section
- Direct comparison with theory, e.g. FDTD
- Comparison “photonic atom” / metamaterial allows for investigation interaction effects in the array

# Characterization of Metamaterials

- Transmittance and reflectance spectroscopy
  - + Easy to do!
  - No phase information!
- Interferometric time-of-flight experiments with fs-impulses:
  - Phase- and group-velocity
  - Influence of interfaces?
- “Retrieval” of effective parameters requires comparison experiment / theory
- Bianisotropy!