CFEL SCIENCE

SEMINAR

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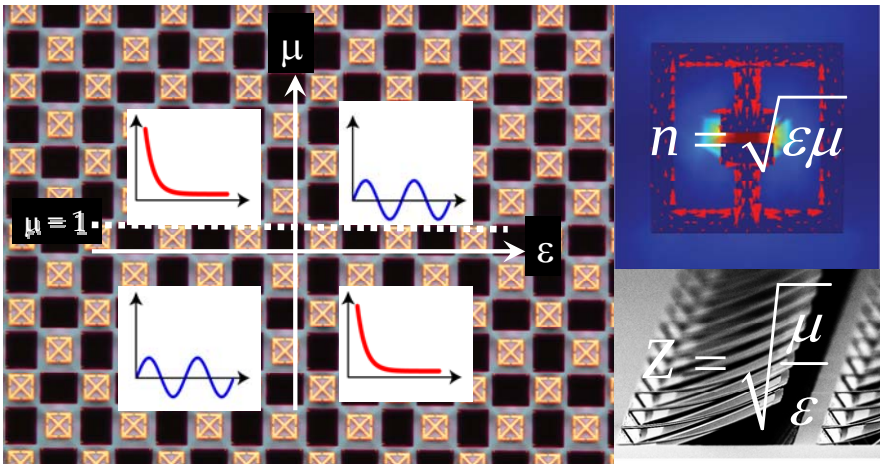
Creating Multifunctional Metamaterials

Metamaterials are a relatively new type of artificial composite with unique electromagnetic properties that derive from sub-wavelength structuring of matter. The canonical sub-wavelength "atom" from which metamaterials are fashioned is the split ring resonator (SRR) consisting of nothing more than an inductive metallic ring with a gap to provide capacitance. This seemingly innocuous particle has resulted in the emergence of a new paradigm in classical electromagnetism during the past decade. Namely, it is possible to design materials which are magnetically resonant at any desired wavelength from the microwave through the visible. This, in turn, has led to the realization that possibilities abound for creating effective materials displaying phenomena not exhibited by naturally occurring materials. This includes negative refractive index and cloaking.

Following an introduction into these exciting developments, I will describe our work at far-infrared wavelengths. Of primary importance is that SRRs strongly interact with the environment through their enhanced local electric and magnetic fields. This provides the potential for creating reconfigurable metamaterial composites and utilizing metamaterials as compact probes of condensed matter phenomena. Recent examples including mechanically actuated metamaterials, artificial magnetoelectrics, and terahertz electric-field induced phase transitions will be presented.



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