Title: “**Liquid crystal plasmonic metamaterials**”

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Abstract (max. 250 words):

Metamaterials today are often realized as complex structured metasurfaces. Their functionality is based on combination of plasmonic resonances in metallic nanostructures and interferences. Novel concepts of bottom up fabrication using liquid crystal self-organization promise the realization of bulk metamaterials. Only very view such composite self organizing materials based on liquid crystals are demonstrated up to now.

In detail we use rod like nematic liquid crystal molecules that are grafted onto gold nanoparticles. Structural analysis is done by X-ray scattering experiments that revealed an arrangement of the nanoparticles in chains similar to the ones found in columnar phases. To aspect are of particular importance: The sufficient size of nanoparticles to achieve efficient plasmon resonance effects and the ligands anchored on the particles that control the self-assembling properties. The combined effect of the ligands birefringence and the anisotropic arrangement of the plasmonic nanoparticles lead to a strong polarization dependence of the metamaterial’s optical properties. These results demonstrate the ability to fabricate a self ordered and tunable metamaterial by chemical engineering of the nanoparticles with liquid crystalline mesogenic ligands.

In our contribution, we show experimental evidence of coupling resonances of metallic nanoparticles in an entire self-organizing material. We give details on the pathway to design such structures and to adjust their optical and mechanical properties. Theoretically insight of the electromagnetic properties is provided and the approaches to effective material design will be given.

100 words summary:

The electromagnetic response of Metamaterial can be managed by combining resonances and interferences of different materials and on different lengths scales. In our contribution we study composite metamaterials containing resonant plasmonic metallic nanoparticles that show organization. The material bases its non-conventional properties on short distance self-organization by mesogens that form a liquid crystal host material. We compare the properties of such materials with other model systems containing organized nanoparticles. Theoretically insight of the electromagnetic properties is provided and we give details on the pathway to design such structures and to adjust their optical and mechanical properties.