Large-Area 3D Plasmonic Crescents with Tunable Chirality

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The subdiscipline of chiral plasmonics studies the interaction of circularly polarized light with metallic nanostructures. Planar achiral crescent-shaped structures have shown strong near-field enhancement, and can be produced easily by colloidal lithography [1,2]. This technique is versatile, and can produce cheap large-area samples (1cm²).
To gain a chiroptical response, arrays of chiral single objects have been produced by a modified on-edge lithographic approach[3]. Here, the 3d chiral crescents are evaporated on a twisted silica crescent (Fig 1). The silica introduces an edge, and by that also 3-dimensionality. The chiroptical response crucially depends on the structural chirality, which we tuned by the position of the edge and the edge thickness. Thus, large degrees of freedom are given to tailor the response of our chiral crescents. These experiments are complemented by finite element simulations and we use a multipole expansion to elucidate the physical origin of the circular dichroism of the crescent structures.

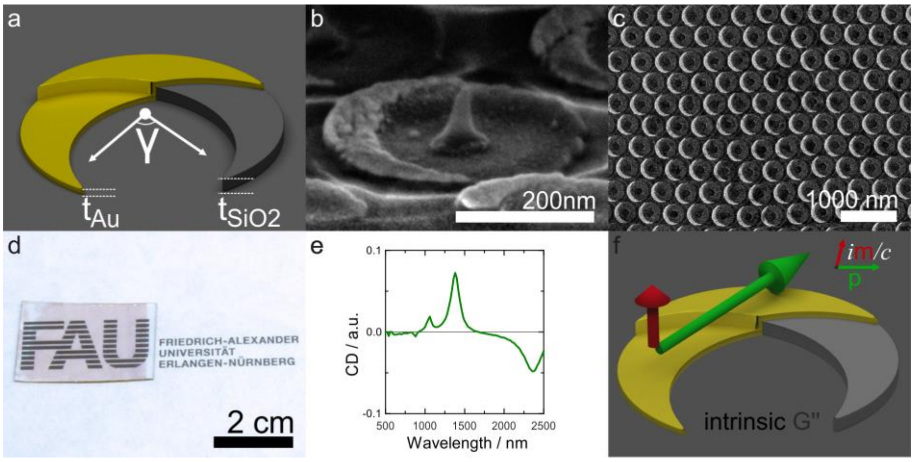

Figure 1. Chiral crescents can be produced by colloidal lithography over large areas. Inserting a silica edge underneath the resonators results in a tunable 3D chiral plasmonic crescent. Overlapping of electric and magnetic dipoles, leading to an intrinsic cross polarizability G´´, resulting in circular dichroism.

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[2] Nicolas Vogel, Janina Fischer, Reza Mohammadi, Markus Retsch, Hans-Jürgen Butt, Katharina Landfester, Clemens K Weiss, Max Kreiter, *Nano letters* **11** (2011), 446.
[3] Eric S. A. Goerlitzer, Reza Mohammadi, Sergey Nechayev, Peter Banzer, Nicolas Vogel, *Adv. Opt. Mater.* (2019), 1801770 (just accepted).

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