Supporting Information for:

Polarization-Controlled Nanogap Cavity with Dual-Band and Spatially-Overlapped Resonances

Qixin Shen[1†], Andrew M. Boyce[2†], Guoce Yang[2,3], Maiken H. Mikkelsen[1,2,]*

[1]Department of Physics, Duke University, Durham, NC 27708, USA

[2]Department of Electrical and Computer Engineering, Duke University, Durham, NC 27708, USA.

[3]State Key Laboratory of Precision Measurement Technology and Instruments, Department of Precision Instrument, Tsinghua University, Beijing 100084, China.

*Correspondence to: m.mikkelsen@duke.edu, +1 (919) 660-0185

†These authors contributed equally to this work.

Fabrication details

A three-step fabrication process is employed in this work. First, 75 nm of gold with a 5 nm chromium (Cr) adhesion layer was deposited onto a silicon substrate by electron beam evaporation, followed by a thin dielectric layer (7 nm Al_2O_3) that was deposited on top of the gold film by atomic layer deposition. Electron beam lithography (EBL) is then used to pattern arrays of absorbing elements on top of the dielectric layer. The size of the elements are characterized by scanning electron microscopy (SEM), while the thickness of the dielectric layer is determined by the deposition rate and verified via ellipsometry measurements.

The colloidal nanocube metasurfaces were fabricated by first dip-coating a single polymer adhesion layer onto the same substrate used for EBL - consisting of 7 nm Al_2O_3 on gold. Nanocubes in water were then dropcast onto the sample using a 10 mm coverslip and a deposition time of 1 hour.

Additional reflection spectra of nanocubes and nanodisks fabricated by EBL

We fabricated six different sizes of both nanocubes and nanodisks using EBL. The reflection spectra are shown in Supplementary Figures 1 and 2. The additonal sizes further demonstrate that the resonance wavlength can be tailored by utilizing different sizes and shapes, with a strong absorption resonance in all cases.

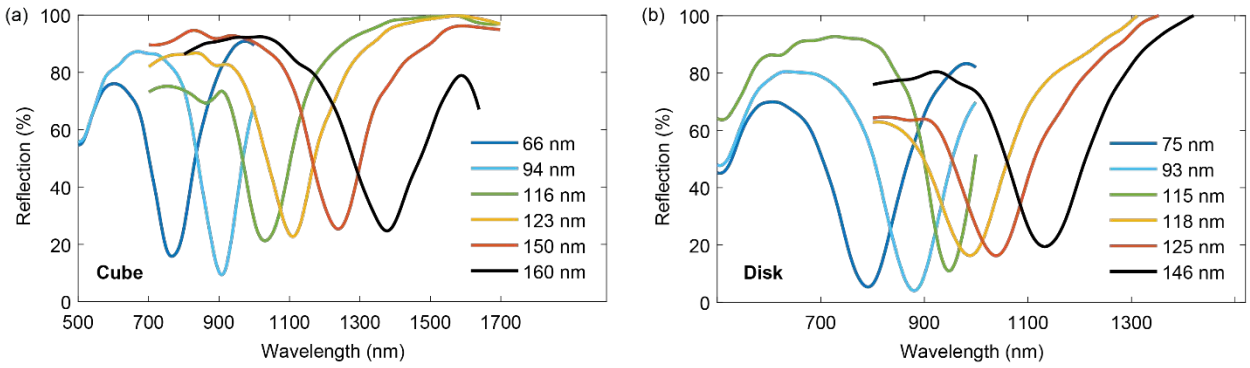

Figure S1. Reflection spectra from EBL-fabricated naoparticles of different sizes: (a) cubes; (b) disks