Supporting Information for "Anapole-enhanced intrinsic Raman scattering from silicon nanodisks"

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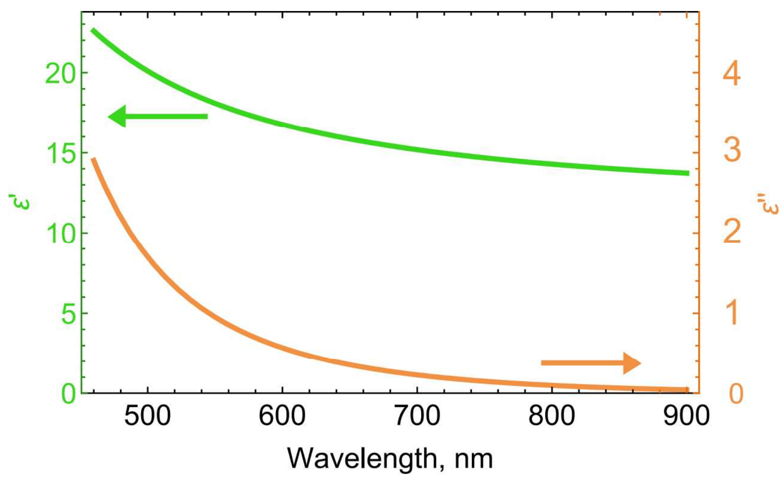

Figure S1: Poly-Si dielectric function obtained using spectroscopic ellipsometry.

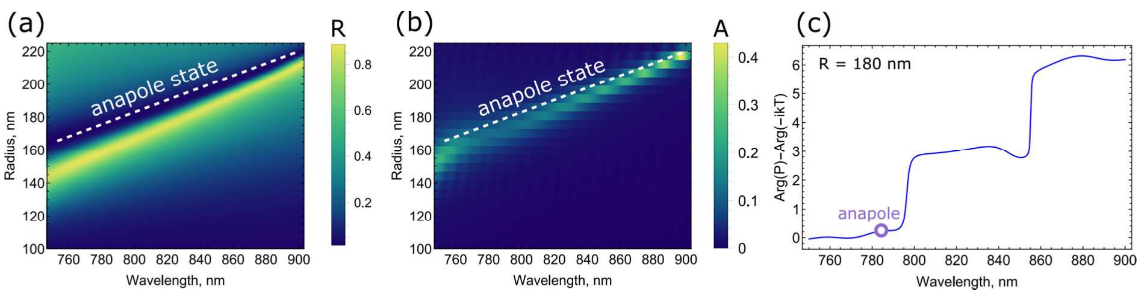

Figure S2: Linear properties of the anapole state. (a) Map of simulated reflection spectra from the Si nanodisks array. (b) The same map for absorption spectra. (c) The phase difference between the electric and toroidal dipole moments induced in a nanodisk inside the array extracted from the multipole decomposition.

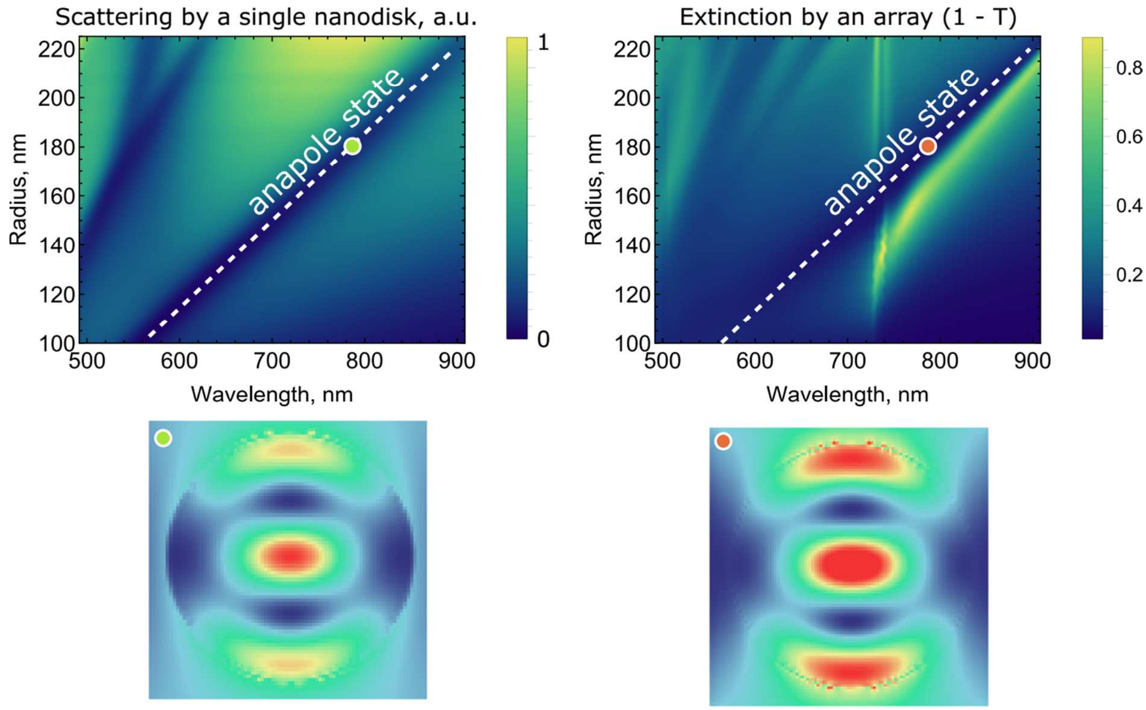

Figure S3. Comparison of the simulated anapole state dispersion in an isolated Si nanodisk and in the periodic array. Pictures at the bottom present electric field intensity in the horizontal plane at the center of the disk under plane wave illumination at the anapole wavelength.

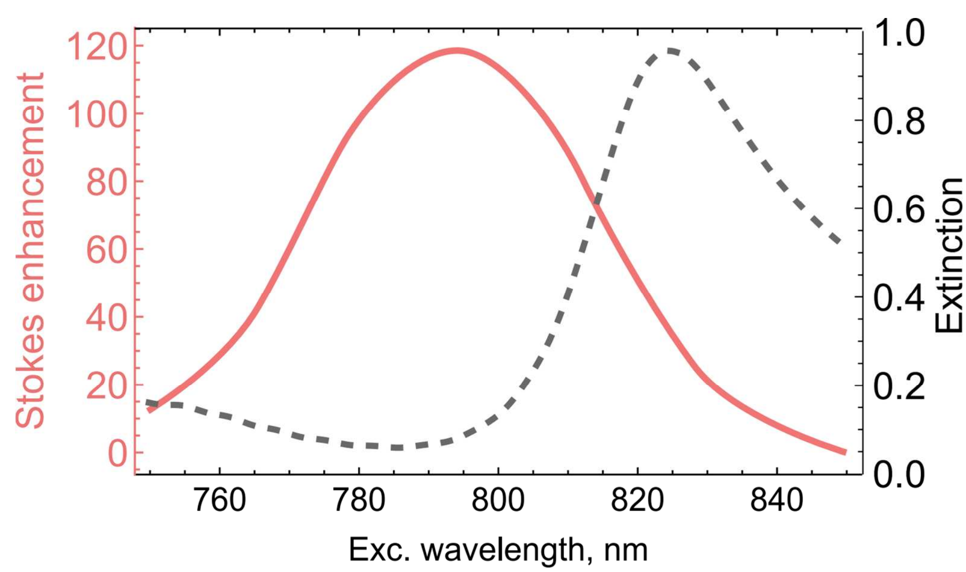

Figure S4. Simulated dependence of extinction and intensity of the Stokes emission on the excitation wavelength for a 180 nm radius nanodisk array normalized by Stokes emission from an unpatterned 70 nm height film.

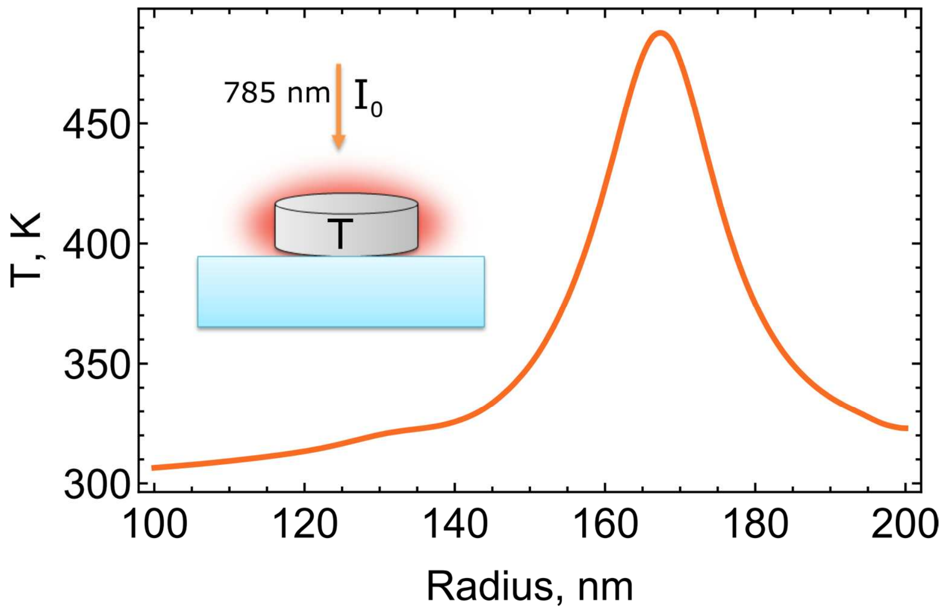

Figure S5: Laser-induced heating of Si nanodisks. Estimation of the stationary temperature of a Si nanodisk of 70 nm height on a glass substrate illuminated by a CW 785 nm laser of 10.85 mW power focused on the area of 1 μm x 1 μm, corresponding to the experimental conditions for anti-Stokes measurements.

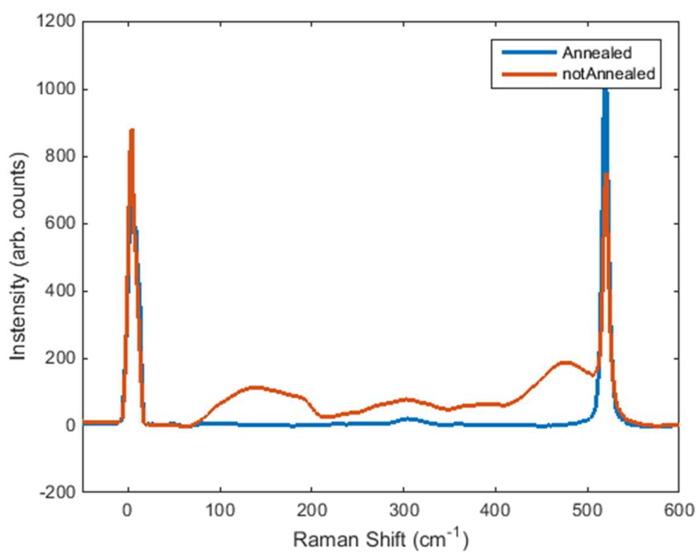

Figure S6. Raman spectrum for an amorphous Si film deposited at 625 ºC (red line) and of a poly-Si film obtained after high temperature annealing (blue line). In the second case, only a peak at 521 cm^{-1} from crystalline Si is clearly visible, while signals at shorter Raman shift produced by amorphous silicon is essentially absent. This result confirms the high quality of the film.

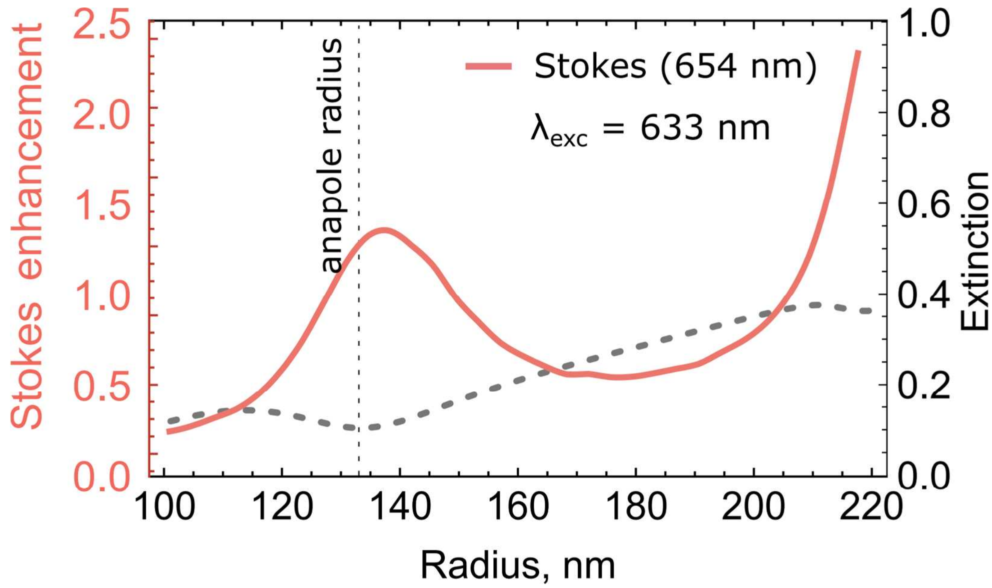

Figure S7. Theoretical analysis of Raman scattering for 633 nm excitation. Solid curve: intensity of the Stokes emission vs disk radius at the excitation wavelength of 633 nm normalized by Stokes emission from an un-patterned film of the same thickness. Dashed curve: extinction of the array vs nanodisk radius at the same excitation wavelength.

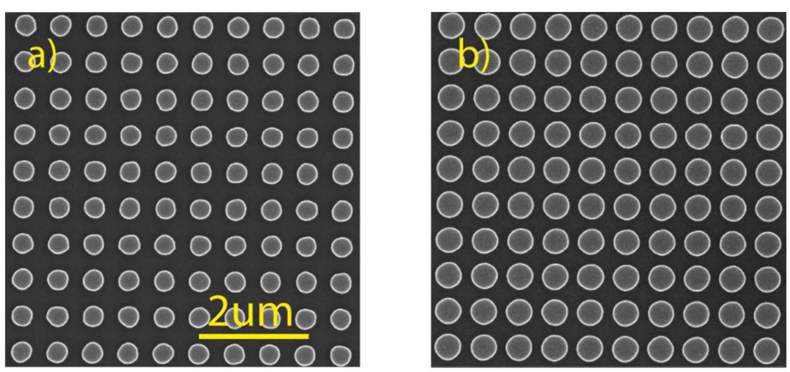

Figure S8. Top view SEM images of the fabricated Si nanodisk arrays with various diameters.

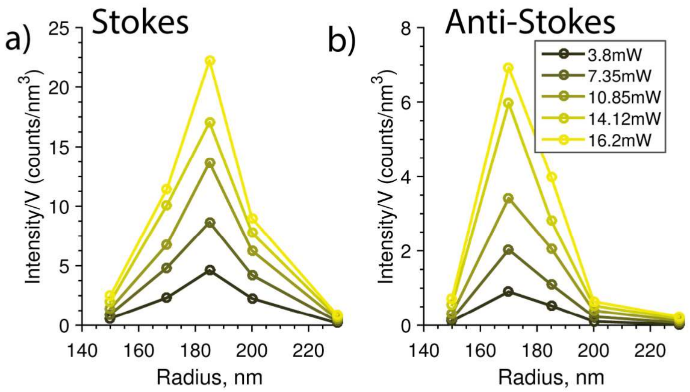

Figure S9. Laser intensity dependent Raman signal. Integrated 521 cm^{-1} Stokes (a) and anti-Stokes (b) Raman scattering intensity from arrays of silicon nanodisks of various radii for 785 nm excitation. Results for different powers show increase in the signal. (c) Intensity ratio between anti-Stokes and Stokes signals versus radius and laser power. The similar curve shapes for different powers indicate only a weak dependence on temperature.