

Electronic Supplementary Information

Plasmonic Polymers Unraveled Through Single Particle Spectroscopy

Liane S. Slaughter^{abc¶}, Lin-Yung Wang^{ab¶}, Britain A. Willingham^{ab}, Jana M. Olson^{ab}, Pattanawit Swanglap^{adb}, Sergio Dominguez-Medina^{ab}, Stephan Link^{abe}*

^a Department of Chemistry, Rice University, 6100 Main St., Houston, TX, 77005, USA

^b Laboratory for Nanophotonics, Rice University, 6100 Main St., Houston, TX, 77005, USA

^c Present address: California NanoSystems Institute, University of California at Los Angeles,
570 Westwood Plaza, Los Angeles, CA, 90095, USA

^d Present address: Department of Chemistry, Silpakorn University, Nakhon Pathom, Thailand

^e Department of Electrical and Computer Engineering, Rice University, 6100 Main St., Houston,
TX, 77005, USA

¶Authors contributed equally

*Address correspondence to slink@rice.edu

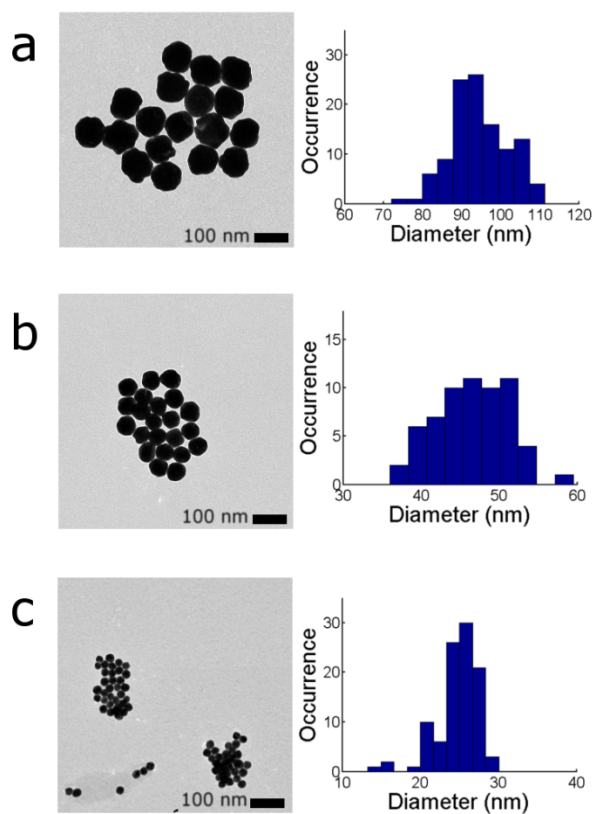


Fig. S1 Representative transmission electron micrographs and corresponding histograms of NP sizes for the three Au NP samples studied here. The mean diameters are (a) 94 ± 8 nm, (b) 47 ± 4 nm, and (c) 25 ± 3 nm.

NP Diameter (nm)	Zeta potential (mV)
94	-57 ± 12 mV
52	-37 ± 12 mV
25	-33 ± 12 mV

Table S1 Zeta potentials of the Au NPs measured in water.

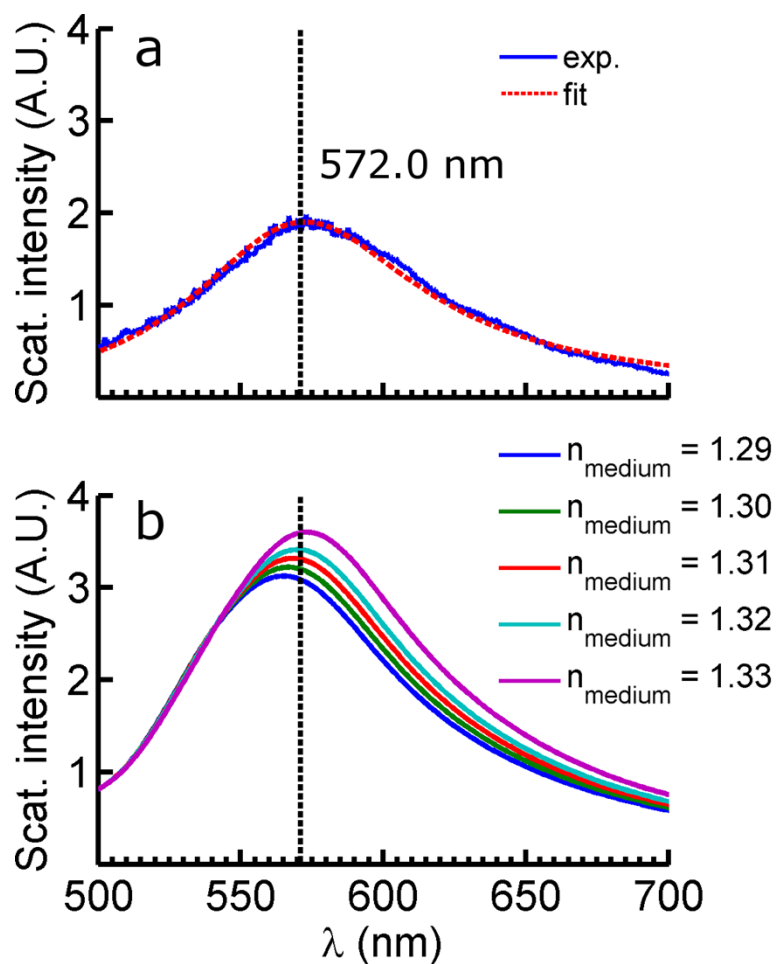


Fig. S2 Representative single particle dark-field scattering spectrum with Lorentzian fit (a) and GMT spectra for different values of the medium dielectric constant (b). The dotted black line indicates the peak position of 572.0 nm determined from the Lorentzian fit. A refractive index of 1.32 provided the best match between experiment and theory and was applied to the calculations of all chains. The 94 nm Au NP sample was chosen for this calibration.

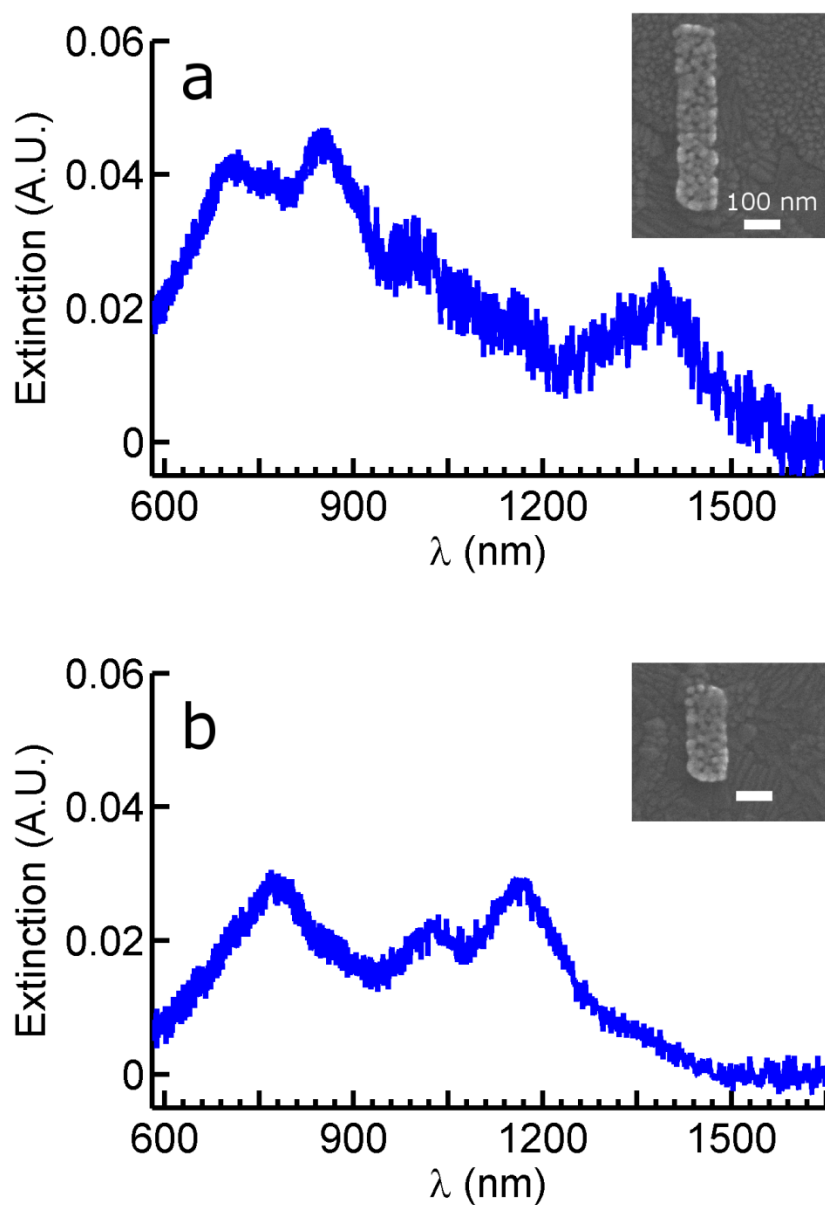


Fig. S3 Extinction spectra of chains of 25 nm Au NPs that have been partially melted and fused together such that conductive interactions contribute to the optical response. The chain in (a) has $L_{Tot} = 500$ nm, corresponding to the chain 20N4 in Fig. 3. The chain in (b) has $L_{Tot} = 260$ nm, corresponding to the chain 9N4 in Fig. 4.

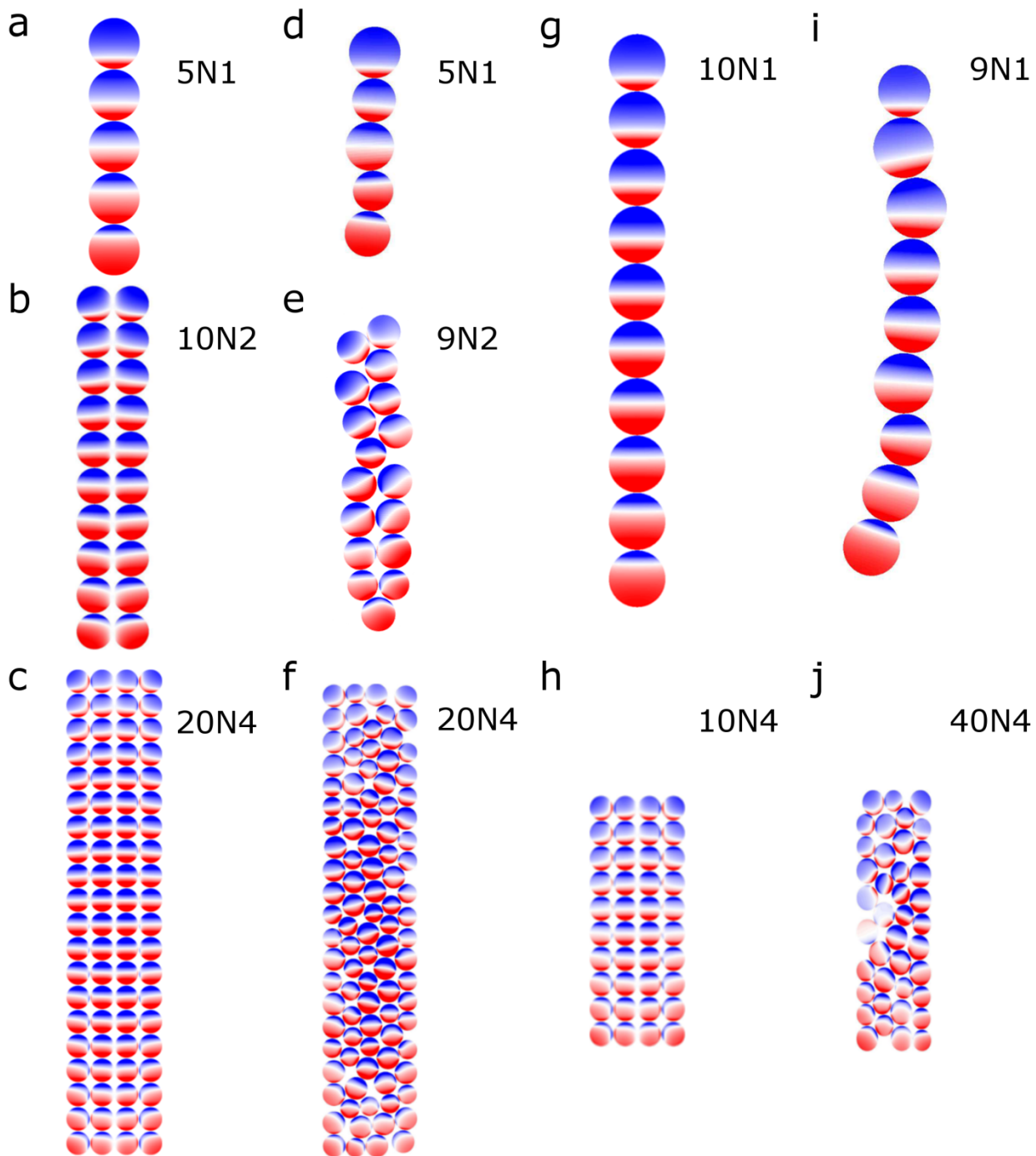
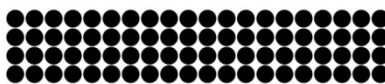


Fig. S4 Enlarged views of the charge distributions of the superradiant modes for the chains shown in Figs. 5 and 6. Note that (g), (h), (i), and (j) correspond to the charge plots in Fig. 6a, 6c, 6d, and 6f, respectively. Because the charge plots in Fig. 5b and 5e are identical to Fig. 6b and 6e, we show them here only once.

AA-Packing



AB-Packing

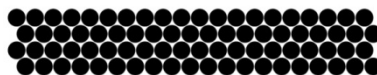


Fig. S5 Illustration of AA- and AB-packing of NPs into chains. The calculated spectra of these idealized geometries are shown in Fig. 5b-c and Fig. 6b-c.

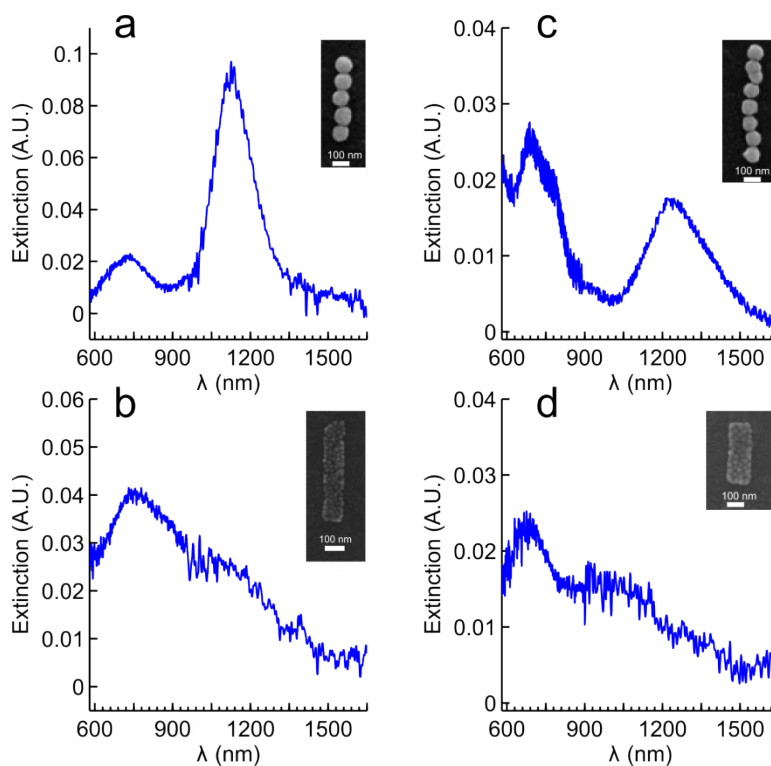


Fig. S6 Additional extinction spectra of chains of 90 nm (a,b) and 25 nm (c,d) Au NPs. Here, (a) & (b) reproduce L_{Tot} for Figs. 3a & 3c respectively, while (c) & (d) reproduce N_L from Figs. 4a & 4c respectively.

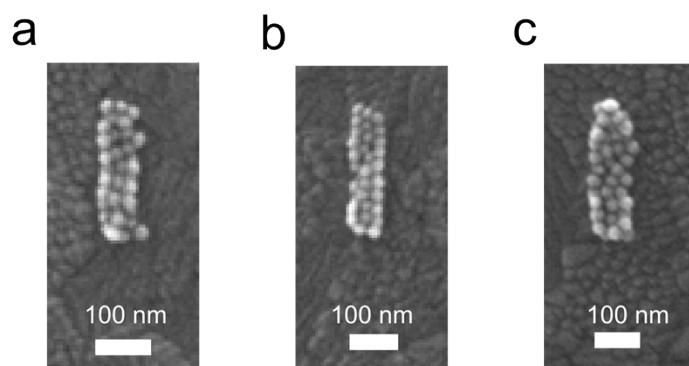


Fig. S7 SEM images of chains with 25 nm Au NPs that show apparent multi-layered structure.

These chains were excluded from the analysis.