

### Supplementary Information

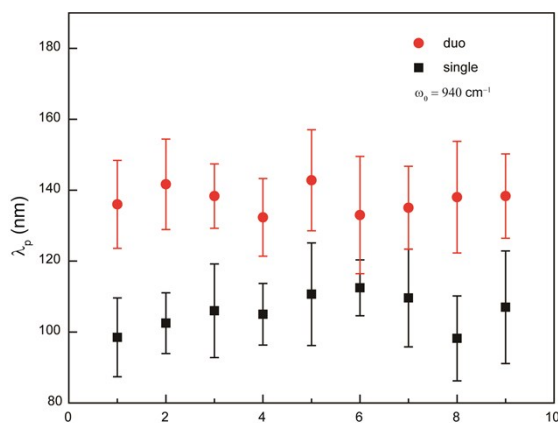


Figure S1: Plasmon wavelengths of single (Black dots) and duo (Red dots) carbon nanotubes systems for different samples with  $940\text{ cm}^{-1}$  photon.

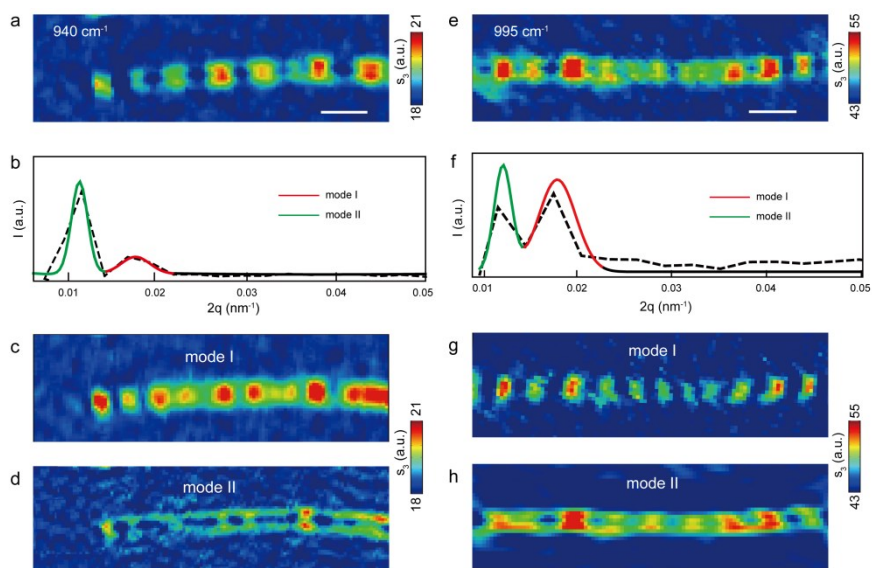


Figure S2: FFT of the near-field optical images in DCNTs. a, e) Infrared near-field optical images of duo nanotubes with  $940$  and  $995\text{ cm}^{-1}$  photon excitation, respectively. b, f) FFT spectrum of near-field optical images of DCNTs corresponding to (a) and (e), respectively. The two peaks are marked as modes I and II. The dotted and solid lines are the experimental data and fitting results, respectively. c-h) Amplitude images obtained by inverse Fourier transform for the two peaks in (b) and (f).