

Supporting Information for “Optical Properties of Star-shaped Gold Nanoparticles”

Nanoparticle Synthesis.

1. Commercial Colloid Seed: A gold nanoparticle growth solution was prepared by adding the following reagents to a plastic tube in the order listed and then gently mixing: 4.75 mL of 100 mM CTAB, 0.2 mL of 10 mM $\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$, 0.03 mL of 10 mM AgNO_3 . Next, 0.032 mL of 100 mM ascorbic acid was added, which changed the solution from brown-yellow to colorless. To initiate nanoparticle growth, 10 μL of undiluted 10 nm gold colloid (Ted Pella) was added to the growth solution, mixed gently, and left still for 3 h.

2. Surfactant-Stabilized Seed: A gold nanoparticle seed solution for nanostar growth was synthesized by combining 0.250 mL of 10mM HAuCl_4 with 7.5 mL of 0.1 M CTAB. To this we added 0.600 mL of ice cold NaBH_4 resulting in a pale brown seed solution. A growth solution was prepared by adding the following reagents to a plastic tube in the order listed and then gently mixing: 4.75 mL of 0.1 M CTAB, 0.2 mL of 10 mM HAuCl_4 , and 0.03 mL of 10 mM AgNO_3 . Solution should be yellow-brown after addition of HAuCl_4 . To this growth solution we added 10 μL of seed, followed by 0.032 mL of 100 mM ascorbic acid. Solution should be clear after addition of ascorbic acid. Finally, 0.025 mL of 0.1 M NaOH was added, followed by gentle mixing. Within 15 minutes the solution was faintly blue-purple, and color deepened over the next 3 hours.

Nanoparticle PEGylation and sample prep

Gold nanostars are stable in concentrated surfactant solution, but the surfactant interferes with sample preparation. We therefore PEGylated the nanostars by adding 50 μL of 0.1 mM 5 kDa PEG-SH to 1 mL of nanostar solution, centrifuging the nanoparticles into a pellet, and then resuspending in water to remove excess CTAB. A drop of the PEGylated nanoparticles was allowed to dry on a slide with alignment marks, and then rinsed with DI water.

Figure S1. High resolution version of the TEM image from Figure 1.

Figure S2. High resolution versions of the alignment images From Figure 2.

Figure S3. SEM images of a nanostar with a 30 degree tilt, demonstrating that these are three dimensional objects. The arrows highlight a star tip that was vertical before the tilt, but moves into the plane of the figure after the tilt.