Supporting information for Angular distribution of surface-enhanced Raman scattering from individual Au nanoparticle aggregates.

by

Timur Shegai, Björn Brian, Vladimir Miljković, and Mikael Käll.

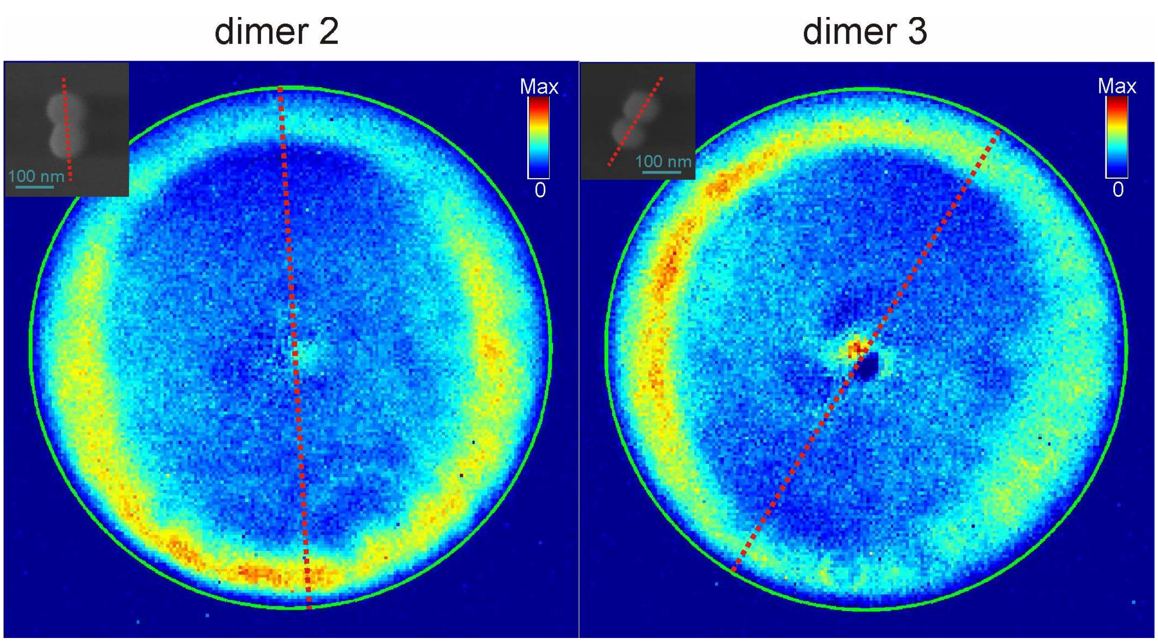

Figure S1. SERS radiation patterns and corresponding SEM images of two additional dimer nanoantennas. Red dotted lines show the direction of the dimer axis. The emission from dimer 2 confirms the dipolar like symmetry, while the emission from dimer 3 is somewhat asymmetric. This is probably a consequence of a symmetry break with respect to the dimer axis (for example if the hot-spot is positioned slightly off the dimer axis) that is not resolved in the low resolution SEM image.

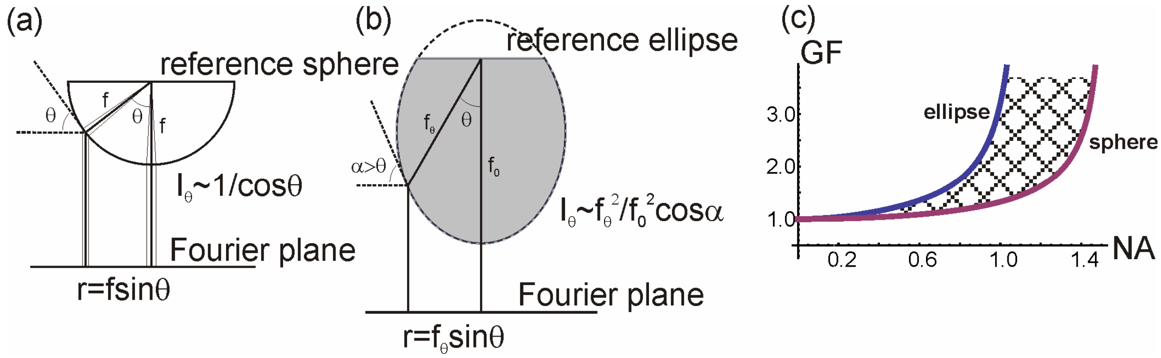

Figure S2. Geometrical factors due to projecting intensity from a spherical wave front on a plane. (a) reference sphere approximation, (b) reference ellipse approximation, (c) geometrical factors as a function of NA, dashed area shows geometrical factor in real microscope objectives.

In the case of the reference sphere approximation, a spherical wave source is positioned at the center of the refractive spherical surface, see Fig. S2(a). In this case, the distance the light travels in glass before it is refracted does not depend on the direction of light propagation and is always equal to *f*. Thus, the projection is defined solely by the propagation direction, i.e. 1/cosθ.

In the reference ellipse approximation, in contrast, the distance from the spherical wave source to the refracting surface, f_θ, depends on the angle θ as shown in Fig. S2(b) and is given by:

$$f_\theta / f_0 = \frac{n-1}{n-\cos\theta} \qquad (1).$$

The angle α, which defines the projection is given by:

$$\tan\alpha = \frac{n\sin\theta}{n\cos\theta - 1} \qquad (2),$$

where n is the refractive index of glass (taken to be 1.52 in the simulations).

Both the reference sphere and the reference ellipse geometrical factors are plotted versus NA in Fig. S2(c). Clearly, the reference ellipse curve increases faster with increasing angle, further stressing the importance of using high NA objectives.

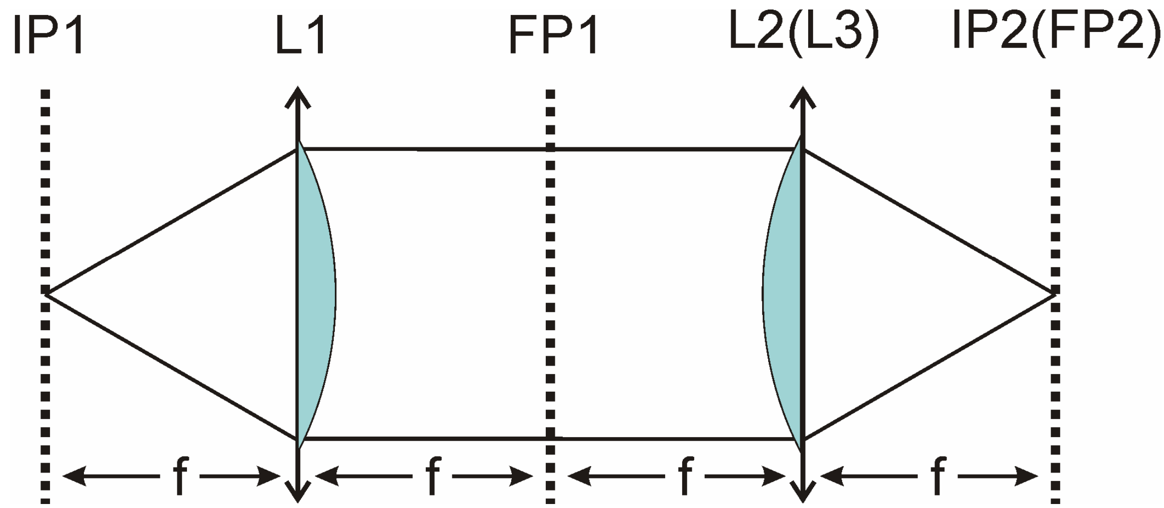

Figure S3. Scheme of the 4*f* correlator, IP1 – image plane 1, L1 – lens 1, FP1 – Fourier plane 1, L2(L3) – lens 2(3), IP2(FP2) – image plane 2 (Fourier plane 2).

The scheme of the 4*f* correlator is given in Fig. S3. The total length of the setup is 4*f*, where *f*=10 cm. The focal distance of L1 and L2 is *f*, while the focal distance of L3 is *f*/2. This means that when L2 is replaced by L3 (both installed on the same rotating wheel holder) the IP2 becomes FP2, which allows both imaging and Fourier imaging on the same CCD detector.