

USING NANO LIGHTENING RODS TO DETECT MOLECULES

Amanda J. Haes, Shengli Zou, George C. Schatz, Richard P. Van Duyne, "A Nanoscale Optical Biosensor: The Long-Range Distance Dependence of the Localized Surface Plasmon Resonance of Noble Metal Nanoparticles," *J. Phys. Chem. B*, 2003, (108), 109–116.

Lightning rods (invented by Ben Franklin) at the top of a building are designed to provide a location where lightning will strike and from which the energy is carried harmlessly to the ground. A needle-like metal tip is used in a lightening rod, since this leads to high electric fields just above the tip when the building is charged relative to the atmosphere above it, providing a more likely location for lightening to strike.

Recently, the authors demonstrated how this idea applies to the tips of nanoscale silver particles and that this makes it possible to use the particles to detect molecules that are adsorbed near to the tips. Computational methods were used to solve Maxwell's equations (the fundamental equations of electricity and magnetism) for light (which is an electromagnetic wave) interacting with the triangular particle. This leads to fields around the particles whose magnitudes relative to the incident light are plotted in the figure. The results show that the light is greatly amplified (by as much as a factor of 65,000) in the region near the particle tip, leading to enhanced sensitivity to molecules that might be located there. This information is being used as the basis for constructing nanoparticle structures for extinction sensing.

