Professor
Naomi J. Halas
Laboratory for Nanophotonics, Rice University

Research interests involve designing new optically active nanostructures driven by function; developing and implementing new nanofabrication strategies to build, orient, and pattern these nanostructures into new materials and devices; characterizing and understanding the physical properties of these optically active nanostructures, devices and materials; and prototyping the use of optically active nanostructures in applications of potential technological and broad societal interest.

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**Plasmonics: from noble metals to sustainability**

**Abstract**
Metallic nanoparticles, used since antiquity to impart intense and vibrant color into materials, have more recently become a central tool in the nanoscale manipulation of light. This interest has led to a virtual explosion of new types of metal-based nanoparticles and nanostructures of various shapes and compositions, and has given rise to new strategies to harvest, control, and manipulate light based on metallic nanostructures and their properties. As one begins to assemble metallic nanoparticles into useful building blocks, a striking parallel between the plasmons—the collective electronic oscillations—of these structures and wave functions of simple quantum systems is universally observed. Clusters of metallic nanoparticles behave like coupled oscillators, introducing effects characteristic of systems as diverse as radio frequency transmitters and coupled pendulums into light-driven nanoscale structures. Plasmons decay by producing hot electrons, a property appearing to be highly useful in applications ranging from photodetection to photocatalysis. In particular, new “antenna-reactor” photocatalysts can be designed by combining plasmonic nanoparticles with directly adjacent catalytic particles or materials, rendering the heterocomplexes photocatalytic. While our scientific foundation for the field of Plasmonics has been built on nanoparticles consisting of noble and coinage metals, more recently we have begun to question whether the same, or similar, plasmonic properties can also be realized in more sustainable materials. Aluminum, the most abundant metal on our planet, can support high-quality plasmonic properties across the visible region of the spectrum, enabling practical large-area and cost-effective plasmonic applications such as flat-panel displays, robust colorimetric sensors, and selective ethylene synthesis. Graphene is an outstanding active plasmonic material, however, it can be tuned from the infrared into the visible region of the spectrum only by miniaturization to the true molecular limit. Sustainable plasmonic materials allow us to envision entirely new applications, for example, direct solar distillation that can provide drinkable water, entirely independent of grid-based electrical power.

**Margaret C. Etter Memorial Lecture in Materials Chemistry**
Margaret “Peggy” Cairns Etter was born on September 12, 1943. She died on June 10, 1992, from cancer. In 1974, she received her doctorate in chemistry from the University of Minnesota under the direction of Jack Gougoutas. She taught organic chemistry at Augsburg College in 1975-76, and worked at the 3M Company from 1976 to 1983. She returned to the University of Minnesota as a postdoctoral fellow with Robert Bryant in 1984 and, within a year, had secured an independent academic appointment. Peggy rose rapidly through the ranks and in 1990 was promoted to full professor. Peggy's outstanding characteristics as a scientist were her infectious enthusiasm, uncompromising scientific standards, and creativity. Her research group made major contributions in the applications of solid-state nuclear magnetic resonance spectroscopy, the design and properties of organic non-linear optical materials, and most significantly, in the understanding and utilization of hydrogen-bonding interactions in crystals. This was reflected in nearly 80 research papers and in several landmark review articles in prestigious journals. Outside recognition in the form of fellowships from the Sloan and Bush Foundations and an Iota Sigma Pi Award for Excellence in Chemistry represent incomplete reflections of the impact of this work. One of her extramural “side projects” was to found a company called “Rochelle Crystal Corporation,” for which Peggy was named St. Paul Businessperson of the Year in 1986.

**Host: Professor Christy Haynes**
Refreshments will be served prior to the seminar.