Edward Noble Kramer was born April 17, 1908 in Cambridge, Wisconsin but grew up in the small town of Oregon, Wisconsin, just south of Madison, where his parents ran a printing business and published the weekly newspaper, the *Oregon Observer*. He received his BS and MS degrees in chemistry from the University of Wisconsin- Madison and after one year as instructor in chemistry at the University of Wisconsin- Extension at Milwaukee, returned to Madison and completed his PhD in chemistry in 1933 at the age of 25. At UW-Madison he was coxswain of the freshman crew and a member of the marching band. He was hired by the DuPont Company at a time that DuPont had started to develop a new business to manufacture titanium dioxide white pigment.

Over the span of his 40 year career at DuPont Dr. Kramer was intimately involved in the chemistry, chemical process engineering, physics and materials science of producing titanium dioxide nanoparticles of optimum size, crystal structure and surface characteristics to be effective paint additives. He had a major role in development of the chloride process for producing the rutile form of titanium dioxide, an exceptionally efficient and controllable process used to produce almost all commercial titanium dioxide. When he retired in 1973 Dr. Kramer was in charge of all technical aspects of the Pigments Department of the DuPont Company.

Since Dr. Kramer's career involved important aspects of the disciplines of chemistry, chemical engineering and materials science and engineering without regard to their sometimes arbitrary academic boundaries, the purpose of the Edward Noble Kramer Distinguished Interdisciplinary Lectures is to illustrate the opportunities for interdisciplinary research involving all three of these disciplines by inviting to campus a distinguished speaker, who by his or her example typifies this interdisciplinary approach and whose lecture will excite and inspire students and faculty from all three disciplines. The lecture series was established in 2008 by Prof. Edward J. Kramer, son of Edward Noble Kramer, who was also a distinguished materials scientist. Until Edward J. Kramer passed away in December 2014, he attended the Kramer Lectures each year. We will miss his involvement in the lecture series.

DEPARTMENT OF Materials Science and Engineering
UNIVERSITY OF WISCONSIN-MADISON

DEPARTMENT OF Chemistry

DEPARTMENT OF Chemical and Biological Engineering
UNIVERSITY OF WISCONSIN-MADISON

The 2018 Edward Noble Kramer Distinguished Interdisciplinary Lecture

Professor Naomi J. Halas

Department of Electrical and Computer Engineering
Rice University

From Faraday to tomorrow: the Growing Importance and Impact of Metallic Nanoparticles

Tuesday, September 18, 2018

Lecture 4:00 PM

1610 Engineering Hall

Reception 3:30 PM

Cheney Room, 1413

Engineering Hall

Professor Naomi Halas is the Stanley C. Moore Professor of Electrical and Computer Engineering at Rice University, where she also holds faculty appointments in the Departments of Physics, Chemistry, and Bioengineering. She is best known as the first person to demonstrate that controlling the shape of metallic nanoparticles determines their color. She pursues fundamental studies of plasmonic and nanophotonic systems and their applications in biomedicine, optoelectronics, chemical sensing, solar steam generation with applications in off-grid water treatment, and most recently, plasmonic photocatalysis. She is author of more than 300 refereed publications, has more than 20 issued patents, and has presented more than 500 invited talks. Dr. Halas is a founder of Nanospectra Biosciences, a Houston-based company developing ultralocalized photothermal therapies for cancer, and Syzygy Plasmonics, a company developing photocatalysts that enable chemical reactions of industrial importance at temperatures far below current technologies. She has been awarded the APS Frank Isakson Prize for Optical Effects in Solids, the R. W. Wood Prize of the OSA, and the APS Julius Lilienfeld Prize for outstanding contributions to physics by a single individual who also has exceptional skills in lecturing to diverse audiences. Halas has been elected to the National Academy of Engineering, the National Academy of Sciences, and the American Academy of Arts and Sciences, and is a fellow of the National Academy of Inventors (all U. S.).

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Previous Kramer Lecturers

2008 Matt Tirrell
2009 Mark Davis
2010 Yet-Ming Chiang
2011 Angela Belcher
2012 Steve George
2013 David Weitz
2014 Joanna Aizenberg
2016 Gerbrand Ceder
2017 Craig Hawker

Faraday to tomorrow: the Growing Importance and Impact of Metallic Nanoparticles

Metallic nanoparticles, used since antiquity to impart intense, vibrant color into materials, then brought to scientific attention in the 19th century as “Faraday’s colloid”, have more recently become a central tool in the harvesting of light energy for an ever-broadening range of applications. By showing that the shape of a noble metal nanoparticle determines the wavelengths of light it can absorb, we introduced the concept of a tunable optical resonance controlled by the collective oscillations of the nanoparticle’s conduction electrons: its plasmon resonance. By tuning the nanoparticle resonance just beyond visible light, into the near-infrared region of the spectrum, we showed how the highly localized heating due to light illumination could be used for photothermal cancer therapy. Now, years after its initial demonstration, this approach is being used in humans for the precise and highly localized ablation of cancerous regions of the prostate, eliminating the highly deleterious side effects characteristic of conventional prostate cancer therapies. By expanding our choice of metals from noble to far more earth-abundant elements, like Aluminum and Copper, we can expand this range of applications even further. Photothermal effects can be harvested for sustainability applications, which we have recently demonstrated in an entirely off-grid solar thermal desalination system that transforms membrane distillation into a scalable water purification process. The plasmon oscillations of metallic nanoparticles can also provide nonequilibrium, “hot” electrons that can, in concert with photothermal effects, drive endothermic chemical reactions under surprisingly mild, low temperature conditions. Within the context of plasmon-driven chemistry, we can begin to clearly distinguish between nonthermal and thermal processes in chemical reactions on metallic nanoparticle antenna-reactor complexes.