Presenter

Dr. Allen Taflove

Professor, EECS Department
Northwestern University
McCormick School of Engineering
2145 Sheridan Rd. Evanston, IL 60208
Phone: (847) 491-4127
taflove@ece.northwestern.edu
http://www.ece.northwestern.edu/ecefaculty/Allen1.html

Abstract

Title: ***Photonic Nanojets***

High-intensity, weakly sub-diffraction, propagating photonic nanojets can emerge at the shadow-side surface of plane-wave-illuminated, mm-diameter, dielectric cylinders and spheres. Theoretical and computational results, bolstered by wavelength-scaled experiments conducted at 30 GHz, indicate that nanojets have the following three key properties:

- Nanojets exhibit narrow minimum transverse beamwidths ranging from $0.3\lambda_0$ to $0.5\lambda_0$ (λ_0 = free-space wavelength), and remain well-collimated over propagation distances of $\sim 1\lambda_0$.
- Nanojets are broadband. That is, they exist for a wide range of incident λ_0 and cylinder or sphere indices of refraction.
- Nanojets provide giant enhancements of the backscattering of nanoparticles. For example, a 30-nm gold nanoparticle passing through the nanojet emerging from a 4-mm-diameter dielectric sphere would temporarily double the observed optical backscattering of the dielectric sphere. In this manner, particles smaller than 5 nm could be detected using visible light.

This presentation will summarize our results to date in this topic area, as well as some of our ongoing research.

Biography

***DR. TAFLOVE** is a professor in the Department of Electrical Engineering and Computer Science of Northwestern's McCormick School of Engineering, where he has been on the faculty since 1984. Since 1972, he has helped to pioneer basic theory and applications of finite-difference time-domain (FDTD) computational electrodynamics. He coined the FDTD acronym in a 1980 journal paper, and was the first IEEE Fellow in the FDTD area. Currently, FDTD is one of the most powerful and widely used methods for solving the fundamental Maxwell's equations for scientific and engineering problems, with ~2,000 FDTD theory and application papers published worldwide each year, and ~30 commercial FDTD software vendors. In 1995, he authored a widely used textbook / research monograph on this subject, Computational Electrodynamics: The Finite-Difference Time-Domain Method, which he expanded and updated to its second edition published in 2000, and further expanded and updated to its current 1038-page third edition published in June 2005. He is included in ISIHighlyCited.com, the Institute of Scientific Information's compilation of the most-cited researchers worldwide.*