Directional light scattering by dielectric nanoparticles

By

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Host: Prof. Shen Zexiang

Abstract

Directional light scattering by spherical silicon nanoparticle in the visible spectral range is experimentally demonstrated for the first time. These unique optical properties arise because of simultaneous excitation and mutual interference of magnetic and electric dipole resonances inside a single nanosphere. Such behavior is similar to Kerker's-type scattering by hypothetic magneto-dielectric particles predicted theoretically three decades ago. Here we show that directivity of the far-field radiation pattern of single silicon spheres can be strongly dependent on the light wavelength and the nanoparticle size. For nanoparticles with sizes ranging from 100 to 200 nm, forward-to-backward scattering ratio above six can be experimentally obtained, making them similar to ‘Huygens’ sources. Unique optical properties of silicon nanoparticles make them promising for design of novel low-loss visible- and telecom-range metamaterials and nanoantenna devices.

Y.H. Fu, A. I. Kuznetsov, A. E. Miroshnichenko, Y. F. Yu and B. Luk’yanchuk, Nature Communications 4, 1527 (2013)

Short Biography

Prof. Dr. Boris LUKIYANCHUK, Division Manager of Advanced Concepts and Nanotechnology, Data Storage Institute, A*STAR, Singapore, graduated from M. V. Lomonosov Moscow State University, Russia in 1967, PhD student at L. D. Landau Theoretical Physics Institute, Academy of Sciences of USSR, supervisor Prof. A. A. Abrikosov (Nobel Prize winner). PhD (Physics and Mathematics) in P. N. Lebedev Physical Institute, Academy of Sciences of USSR, 1979. Doctor of Sciences (Physics and Mathematics) - Second Doctorate in General Physics Institute, Academy of Sciences of USSR, 1991. State Professor's Degree (Physics and Mathematics) from State Highest Certifying Committee of Russian Federation, 1992. Working as Senior Scientist at P. N. Lebedev Physical Institute, Academy of Sciences of USSR, Moscow; Principal Scientist and the Head of the Laboratory at General Physics Institute, Russian Academy of Sciences, Moscow till 1999. Working abroad as visiting Professor and invited Professor in Austria, Italy, France, Sweden, Japan, Australia. Since 1999 - Professor, Principal Scientist and Division Manager at Data Storage Institute, Agency for Science, Technology and Research, Singapore.


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