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**Dielectric Optical Antenna Emitters and Metamaterials**

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Optical antennas are critical components in nanophotonics research due to their unparalleled ability to concentrate electromagnetic energy into nanoscale volumes. Researchers typically construct such antennas from wavelength-size metallic structures. However, recent research has begun to exploit the scattering resonances of high-permittivity particles to realize all-dielectric optical antennas, emitters, and metamaterials. In this talk, we experimentally and theoretically characterize the resonant modes of subwavelength rod-shaped dielectric particles and demonstrate their use in negative index metamaterials and novel infrared light emitters. At mid-infrared frequencies, Silicon Carbide (SiC) is an ideal system for studying the behavior of dielectric optical antennas. At frequencies below the TO phonon resonance, SiC behaves like a dielectric with very large refractive index. Using infrared spectroscopy and analytical Mie calculations we show that individual rod-shaped SiC particles exhibit a multitude of resonant modes. Detailed investigations of these SiC optical antennas reveal a wealth of new physics and applications. We discuss the distinct electromagnetic field profile for each mode, and demonstrate that two of the dielectric-type Mie resonances can be combined in a particle array to form a negative index metamaterial [1]. We further show that these particles can serve as "broadcasting" antennas. Using a custom-built thermal emission microscope we collect emissivity spectra from single SiC particles at elevated temperatures, highlighting their use as subwavelength resonant light emitters. Finally, we derive and verify a variety of general analytical results applicable to all cylindrical dielectric antennas and discuss extensions of the demonstrated concepts to different materials systems and frequency regimes. [1] J.A. Schuller, et al., Phys. Rev. Lett. 99, 107401 (2007)