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Optical Antennas for Enhanced Light Absorption and Emission[1]

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The absence of optical antennas in technological applications is primarily associated with their small scale. Antennas have characteristic dimensions on the order of a wavelength, demanding fabrication accuracies better than 10nm for the optical frequency regime. The advent of nanoscience and nanotechnology provides access to this length scale but material challenges associated with optical antennas remain. For example, the penetration of radiation into metals can no longer be neglected. The electromagnetic response is then dictated by collective electron oscillations (plasmons) characteristic of a strongly coupled plasma. These collective excitations make a direct downscaling of traditional antenna designs impossible and demand the careful study of plasmon resonances in metal nanostructures. The introduction of the antenna concept into the optical, infrared and terahertz frequency regime holds promise for a wide range of novel technological applications. Optical antennas can be employed to enhance the efficiency of photovoltaics, to release energy from nanoscale light-emitting devices, and to boost the efficiency of photochemical or photophysical detectors. In this presentation, I will outline the physical properties of optical antennas, review relevant history and recent work.

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