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Electric, magnetic and electromagnetic hot spots

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We study plasmonic antennas featuring areas of extremely concentrated electric or magnetic field, known as hot spots. To this end we use optical spectroscopy and electron beam spectroscopy together with numerical modeling. We combine two types of electric-magnetic complementarity to increase the degree of freedom for the design of the antennas: bow-tie and diabolo duality and Babinet's principle. We evaluate the figures of merit for different plasmon-enhanced optical spectroscopy methods: field enhancement, decay rate enhancement, and quality factor of the plasmon resonances. The role of Babinet's principle in interchanging electric and magnetic field hot spots and its consequences for practical antenna design are discusses. Finally, we propose Babinet-type dimer antenna featuring electromagnetic hot spot with both the electric and magnetic field components treated on equal footing. We particularly focus on antennas featuring magnetic hot spots in the THz spectral range, and discuss their application in plasmonenhanced electron spin resonance.