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Quantum Beats from Entangled Localized Surface Plasmons[1]

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Recent experiments report observations of quantum interference between plasmon resonances, inviting descriptions of plasmon-photon interaction using methods from quantum optics. Here we demonstrate, using a Heisenberg-Langevin approach, that the radiation emitted from the localized surface plasmon resonances of a mixed-metal heterodimer may exhibit observable, beat frequency interferences at a far-field detector, known as quantum beats. This prediction represents a correspondence between V-type atoms of quantum optics and the familiar heterodimer system of plasmonics. We explore this analogy in depth and find that although both systems support quantum beats, the heterodimer emits photons in bunches due to the bosonic nature of the plasmon. This highlights a significant difference between the properties of atomic and plasmonic systems.

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