

Abstract:

There are two conflicting narratives of Electromagnetics in metals:

1. The *microwave circuit narrative* in which metals, distributed capacitors, and distributed inductors function together in a high frequency circuit, albeit as distributed components. Here there is a rich tradition of various electromagnetic functions, including the antenna function.
2. This is countered by *the optical-plasmonic narrative*, in which metallic electromagnetics is thought to be dominated by plasmons, electromagnetic normal modes in which the inertia of the electrons plays a major role.

Given that Electromagnetics is generally invariant with frequency, it is not clear why there need to be two separate narratives. Is metal-optics simply the high frequency version of microwave electromagnetics? There is great benefit in unifying our understanding of the two regimes of metallic electromagnetics, and to distinguish the occasional role of electron inertia.

We find that some of the most important metal-optics functions are best understood as extensions of microwave electromagnetics: Antennas, for example, have been thoroughly under-estimated, and are well-poised to change the rules of optical physics.