Plasmonic nanostructures: local versus nonlocal response

We study the importance of taking the nonlocal optical response of metals into account for accurate determination of optical properties of nanoplasmonic structures. Here we focus on the computational physics aspects of this problem, and in particular we report on the nonlocal-response package that we wrote for state-of-the-art numerical software, enabling us to take into account the nonlocal material response of metals for any arbitrarily shaped nanoplasmonic structures, without much numerical overhead as compared to the standard local response. Our method is a frequency-domain method, and hence it is sensitive to possible narrow resonances that may arise due to strong electronic quantum confinement in the metal. This feature allows us to accurately determine which geometries are strongly affected by nonlocal response, for example regarding applications based on electric field enhancement properties for which metal nanostructures are widely used.