Plasmonic nonlinearities at propagation and storage

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Although surface plasmons are not long propagating waves, the ultrahigh field confinement and the unique dispersion characteristics – are a potential source for substantial nonlinear properties.

In this talk we'll discuss propagation of nonlinear waves in plasmonic nanostructures. Plasmon-soliton propagation is shown to be enabled – exhibiting ultra small confinement of the electromagnetic field. This soliton is unique by having two important polarization components – including a substantial longitudinal field. Generating such solitons around a circular metallic rim is considered.

At high confinement – the field is mainly restricted to the metal and majorly longitudinal. At this point metal nonlinearity becomes important. We'll describe in details the effect of high fields in plasmonic nanostructures. The ponderomotive force – electron depletion from high field regions is shown to be the native nonlocal non linearity in metal – and we analyze propagation of plasmon polaritons due to this effect. It is shown that the ponderomotive force results in a large Kerr like nonlinearity which slows the plasmon propagation and generates intensity induced cutoff. We will show also that this nonlinearity – may limit the field enhancement of localized plasmons in metal nanoparticle.

In addition and if time allows - we'll describe metal nonlinearities due to symmetry breakdown and slow plasmon propagation.