Surface Plasmon Resonance in a metallic nanoparticle embedded in a semiconductor matrix: exciton-plasmon coupling

They consider the effect of electromagnetic coupling between localized surface plasmons in

a metallic nanoparticle (NP) and excitons or weakly interacting electron-hole pairs in a semiconductor

matrix where the NP is embedded.

An expression is derived for the NP polarizability renormalized by this coupling and two possible situations are analyzed, both compatible
with the conditions for Fano-type resonances:

- a narrow-bound exciton transition overlapping with the NP surface plasmon resonance (SPR), and
- SPR overlapping with a parabolic absorption band due to electron-hole transitions in the semiconductor.

The absorption band line shape is

strongly non-Lorentzian in both cases and similar to the typical Fano spectrum
in the case (i).

However, it looks differently in
the situation (ii) that takes place for gold NPs embedded in a CuO film and the
use of the renormalized polarizability derived in this work permits to obtain a
very good fit to the experimentally measured LSPR line shape.