

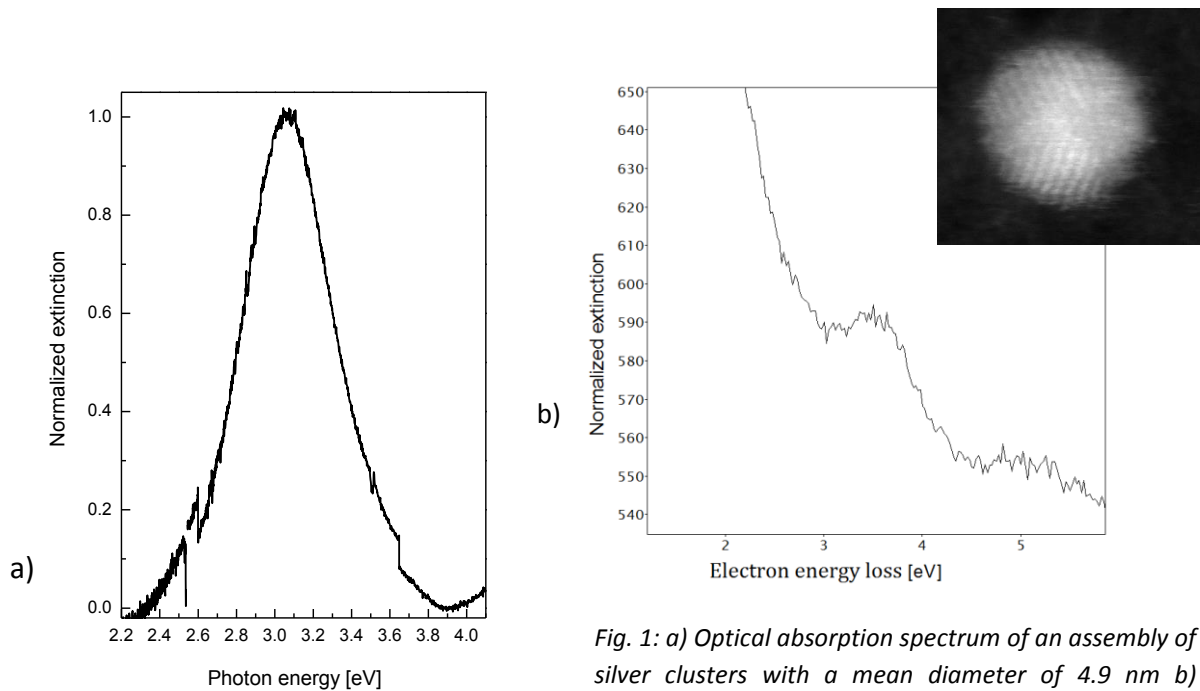
# Quantum effects on metallic clusters physical properties

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The aim of this work is to study quantum effects appearing in very small metallic clusters caused by the increasing surface/volume ratio and the discretization of the electronic structure. Investigating effects such as size dependencies demand a very high quality of the studied nanoparticles, monodisperse in the ideal case. We fabricate nanostructures by embedding silver clusters generated in a magnetron source in solid matrices, such as silica in the present case. This technique gives us full and independent control over the particle composition, size and concentration. A quadrupole mass spectrometer is used as a size filter to obtain a more precise and narrow distribution.

Samples have been characterized with two complementary methods: optical transmission spectroscopy of ensembles of particles and electron energy loss spectroscopy (EELS) on single particles using a scanning transmission electron microscope. Although these two tools are conceptually different, they both measure the plasmonic resonances of metal nanoparticles. The objective of this work is to link theory and experiment in these two methods in order to understand how the physical properties of these small noble metal clusters are affected by quantum effects.



*Fig. 1: a) Optical absorption spectrum of an assembly of silver clusters with a mean diameter of 4.9 nm b) Electron energy loss spectrum of a single silver particle with a diameter of 3 nm with the associated High Angle Annular Dark Field image. In both cases the nanoparticles are embedded in silica.*