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Spectral identification in the attogram regime through laser induced breadown spectroscopy of single opticallytrapped nanoparticles in air

Javier Laserna1, Pablo Purohit; Universidad de Malaga

Abstract:

Current trends in nanoengineering are bringing along new structures of diverse chemical compositions that need to be meticulously defined to ensure their correct operation. Few methods can provide the sensitivity required to carry out measurements on individual nanosubjects without tedious sample pre-treatment or data analysis. In the present study, we introduce a pathway for the full elemental identification of single nanoparticles that avoids suspension in liquid media by means of optical trapping and laser-induced plasma spectroscopy. We demonstrate spectroscopic detection and identification of individual Cu nanoparticles of masses down to 73 attograms and report, for the first time, stable optical trapping in air and manipulation of Cu particles from 25 to 70 nm in diameter. We found an increase in the absolute number of photons produced as size of the particles decreased; pointing towards a more efficient excitation of ensembles of only 7 x exp(-5) Cu atoms in the onset plasma.