

Theoretical Atto-Nano Physics

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In this talk I'll summarize the theoretical work we have done to tackle the underlying physics of laser-matter processes driven by spatially and temporal synthesized fields, with a main emphasis in above-threshold ionization (ATI) and high-order harmonics generation (HHG) in atoms induced by plasmonic fields. It is well known that one of the main theoretical assumptions in the modelling of laser-matter phenomena is that the laser electric field is spatially homogeneous in the region where the electron dynamics takes place. When we *relax* this premise, i.e. when the laser electric field presents variations at a nanometric scale, we open a new and appealing scenario. By using classical, semiclassical and quantum mechanical theoretical tools we were able to shed some light about the modifications produced by spatially inhomogeneous fields - fields which present spatial variations in a scale comparable to the one of the electron dynamics. I will also discuss about the experimental challenges we face, in order to confirm our predictions, and alternative approaches we thought could be more plausible to implement.