Matter at the nanoscale: study of the structure and dynamics of clusters

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Clusters and nanoparticles often have properties rather different to those of the corresponding bulk material, which is due to their large surface-to-volume ratio and in general to quantum size effects, the discretization of otherwise continuous densities of states. Especially the latter effect makes them highly interesting candidates for the study of few to many particle physics. In this talk the intricate interplay between electronic and geometric structure in simple metal clusters will be discussed, which has been clarified by a combination of photoelectron spectroscopy on free, size-selected alkali and noble metal clusters and DFT-calculations [1,2]. Recently the use of angle-resolved photoelectron spectroscopy here even allowed obtaining direct information on the nature of the electronic wavefunctions in these particles [3]. New results demonstrate that the angular distributions can also be used to characterize the ultrafast multi-electron dynamics during the photoionization process. It turns out that these dynamics lead to a surprisingly simple and universal form of the angular distributions, which neither depend on the cluster size nor on the cluster material. I will finish with an outlook on future experiments.

References

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