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Quantum dynamics in clusters

Clusters and nanoparticles often have properties rather different to those of the corresponding bulk material, which is due to the 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 my talk I will concentrate on two examples. First I will explain the intricate interplay between electronic and geometric structure in simple metal clusters, 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 electronicwavefunctions in these particles [3]. The second example will focus on the interplay of geometric structure and thermodynamical properties. Here I will discuss the melting of sodium and water nanoparticles, which exhibit a completely different behavior; while the sodium particle undergo the finite-size analogue of a first order phase transition [4], the water particles seem to undergo rather a glass transition [5]. I will finish with an outlook on future developments in cluster science.

References

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