SIZE EFFECTS IN THE LIFETIME OF ELECTRON EXCITATIONS IN METALLIC CLUSTERS

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The reduction in size of a given material to the nanometric scale leads to important modifications in its physical properties, with a transition from the features characteristic of extended systems to a behaviour more similar to the atomic or molecular state. The detailed study of the variation of these properties with the size of the system provides the necessary ground for predicting the technological applicability, such as the design of new materials with desired electronic, optical or mechanical properties.

Our work is focused on the study of a given type of nanometric structures, namely metallic clusters. The lifetimes of electronic excited states in this type of structures have been recently measured very accurately, and their dependence with the size of the structure has been analysed [1,2]. Here we present a theoretical study of the electronic excitations and their lifetimes in metallic clusters. The jellium model is taken as starting point and spherical symmetry is assumed. The ground state is characterized by means of density functional theory calculations. The response function, used to determine the spectrum of electronic excitations, is calculated within linear response theory. Finally, the lifetimes of excited electrons are calculated for different clusters of increasing radius using first-order perturbation theory. Our results show the sensitivity of electron dynamics to the cluster size.

References:

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