

# **Tailoring Carbon Nanostructures: Unraveling the Electronic Properties of Low-Dimensional Quantum Solids**

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The presentation will give an overview on our current research focus on the electronic properties of low dimensional quantum solids. These properties are strongly influenced by basic correlation effects. Archetypical examples of these systems are graphene, graphite and single wall carbon nanotubes (SWCNT) which are determined by the local arrangement of their  $sp^2$  hybridized carbon atoms, such that their character is either semi-metallic, insulating, semiconducting or metallic. Examples of the recent work on how one can analyze these electronic properties using high energy spectroscopy (electron energy-loss, photoemission and x-ray absorption spectroscopy) as a probe will be presented. Special emphasis will be given to the influence of basic correlation effects and local field corrections on the electronic properties of graphene, graphite and SWCNT. The latter exhibit for metallic tubes a Luttinger liquid behavior.

Furthermore, an overview on how to functionalize nanotubes in order to tailor their electronic structure will be given. This includes examples for the three alternative doping routes, namely, substitution, intercalation and endohedral doping (e.g. by filling with fullerenes and metallocenes) as well as examples for the growth of defined innertubes from the different precursors via a thermal nanochemical reaction. In comparison to graphite intercalation compounds, the electronic structure of doped graphene will be unraveled and for metallic functionalized nanotubes doping induced changes will be discussed in the framework of a dimensionality crossover which causes a change from a one-dimensional metal to a normal Fermi liquid. The detailed understanding of these fundamental electronic properties of functionalized graphite, SWCNT and graphene is key to their future success.