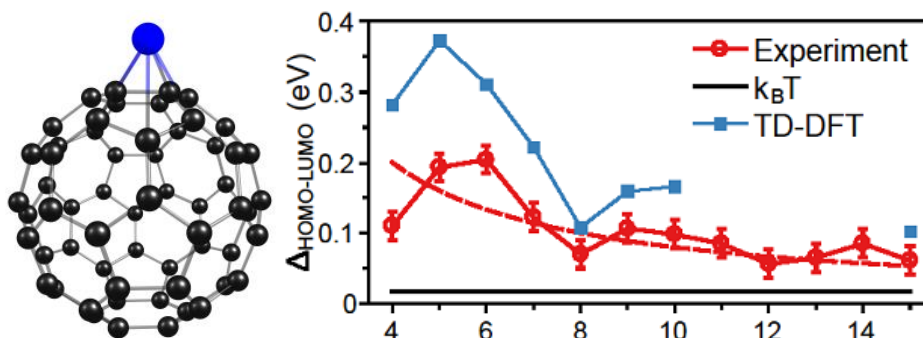


# Infrared characterization of laser synthesized metal clusters and metal fullerene complexes: from vibrations to intra d-band transitions

Joost M. Bakker

Radboud University, Institute for Molecules and Materials, HFML-FELIX Laboratory  
Nijmegen, the Netherlands

Atomic clusters uniquely bridge the gap between the discrete electronic levels of atoms and the correlated band structure of bulk matter. As a well-defined and fully controllable system free from outer influences, gas phase clusters are used as model systems for the active site in heterogeneous catalysis, as potential seed species for the formation of more complex materials in the interstellar medium, and as models for the emergence of bulk properties. Because of their quantum nature, cluster properties can drastically vary, with order of magnitude changes upon the addition or elimination of a single atom. The FELIX infrared free-electron lasers provide broadly tunable and intense light in the THz to near-IR spectral range. In this talk, I will discuss how to utilize this radiation for structural characterization of on-the-fly synthesized metal-fullerene complexes as well as for cluster systems of pure and doped metal atoms, where amongst others, we seek to characterize low-lying electronic states, indicative for the still molecule-like nature of these particles.



*Figure: left metal decorated C<sub>60</sub>; right: band gap for cobalt clusters as function of the number of atoms*