# From Cluster Superlattices to Cluster Membranes

Thomas Michely

Universität zu Köln, II. Physikalisches Institut

Regular arrays of metal clusters can be templated by large supercell moirés formed by two dimensional layers with a substrate. Such templated cluster superlattices display attractive features: a narrow size distribution, a uniform spacing, an identical environment for each cluster and a record high cluster density. This reduction of randomness makes them a viable alternative to supported mass-selected clusters as well as to clusters formed via nucleation and growth on a substrate, when fundamental studies in nanomagnetism and nanocatalysis are under concern.

In the present talk cluster superlattices on graphene/Ir(111) and on a monolayer of hexagonal boron nitride on Ir(111) are introduced through the analysis of their fundamental properties. The mechanism of templating based on selective chemical binding is investigated in detail.

The sintering problem of catalysis is especially demanding for cluster superlattices: due to the smallness of the clusters, (a few to a few 100 atoms) with the correspondingly high chemical potential, and their dense spacing, cluster coalescence is likely, e.g. by Smoluchowski ripening. To solve this problem the concept of the cluster superlattice membrane is introduced. Conformal embedding of cluster superlattices into a matrix and the split-off from the metal substrate are demonstrated, and thus two important steps for membrane formation.