

Title: From atoms to quasicrystals: quantum simulations in experimental synthetic systems.

Abstract: The use of synthetic quantum systems makes it possible to study phenomena that are difficult to measure with conventional experiments. In our experiments, we use scanning tunneling microscopy and atomic manipulation to assemble nanoscale two-dimensional quantum systems that have the physics of atoms, molecules, lattices and quasicrystals. We arrange carbon monoxide molecules one-at-a-time to design the potential landscape that constrains the electrons of the surface states of copper. Then we use the imaging and spectroscopic capabilities of the STM to probe the density of states of the electrons in these structures with much greater detail than it is possible in natural systems. I will be showing results that range from the electronic states in chemical bonds to the quasicrystalline states in a Penrose tiling structure.