Universität Münster

Fachbereich Physik

# Allgemeines Physikalisches Kolloquium

## Donnerstag, 14.12.2023 - 16 Uhr c.t.


## Prof. Dr. Daniel Wegner

Radbound Universiteit Nijmegen




### Quantum simulator to emulate lower dimensional molecular structure


Designing materials with tailored physical and chemical properties requires a quantitative understanding of interacting quantum systems. In order to provide predictability, a promising route is to create bottom-up platforms, where the electronic properties of individual and interacting atoms can be emulated in a tunable manner. Here, we present a solid state quantum simulator based solely on patterned Cs atoms on the surface of semiconducting InSb(110). We use this platform to locally bind electrons in traps that emulate artificial atoms, by precisely positioning Cs atoms with the tip of a scanning tunneling microscope (STM). The bound localized states are probed and mapped via scanning tunneling spectroscopy (STS). These artificial atoms serve as building blocks to realize artificial molecular structures with different orbital symmetries. We find bonding and anti-bonding states for coupled dimers of artificial atoms and orbitals of higher symmetries (π orbitals) for a linear assembly of a few artificial atoms. Based on these artificial orbitals and various atomic patterns, we emulate the structure and orbital landscape of well-known planar organic molecules, including antiaromatic molecules. Presented results validate this new quantum simulator platform and prove its high tunability. I will provide an outlook toward a many-body quantum simulator.



*E. Sierda et al., Science 380, 1048 (2023)*


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Kolloquiums-Kaffee ab 16 Uhr vor dem Hörsaal

Institutsgruppe 1 – HS 2
Wilhelm-Klemm-Str. 10