

Physikalisches Kolloquium

Thursday, 07.06.2018, 16:15, HS 100

Reception with coffee & cookies 15:45

(For university staff: please bring your own cup for sustainability reasons)

Dr. Martin Zeppenfeld, Max-Planck-Institut für Quantenoptik, Garching:

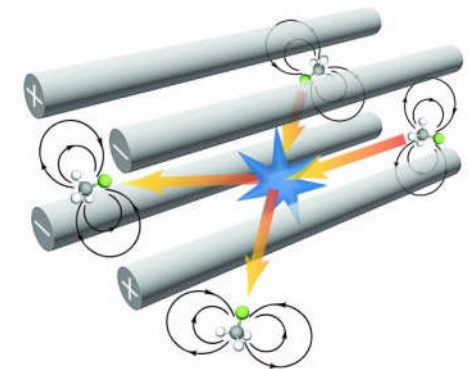
Taming polar molecules for quantum experiments

Abstract

Polar molecules offer fascinating opportunities for quantum experiments at cold ($<1\text{K}$) and ultracold ($<1\text{mK}$) temperatures. For example, chemistry at low temperatures features new possibilities such as controlling chemical reactions via electric and magnetic fields or observing reactions based on tunnelling through a reaction barrier. Precision measurements on molecules provide insight into fundamental physics, allowing investigation of physics beyond the standard model. Attaining sufficient control over molecules provides opportunities for quantum simulations and quantum information processing.

Following an overview of these exciting prospects, I will present our achievements in developing techniques to attain the required ensembles of cold and ultracold molecules. Our cryofuge, the combination of buffer-gas cooling and centrifuge deceleration, produces a record high flux of molecules at temperatures below 1K . Optoelectrical Sisyphus cooling, applied to polyatomic formaldehyde molecules (CH_2O), produces a record large ensemble of roughly 300,000 molecules below 1mK . Combining very long interaction times with sufficiently high densities has allowed us to reach a collision-limited regime for a wide range of molecule species at sub-Kelvin temperatures, thus opening the door to cold quantum chemistry.

In the last part of my talk, I will present new work focussed on realising a quantum hybrid system combining polar molecules and Rydberg atoms.



All of you interested in physics are cordially invited!