Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

IRTG-Seminar

Dr. Martin Zeppenfeld

Max Planck Institute of Quantum Optics, *Garching, Germany*

"Controlled ensembles of cold and ultracold polyatomic molecules"

Recent times have seen a burst of progress for techniques to cool molecules to ultracold temperatures (T<1mK) required for quantum experiments with molecules, with a MOT for molecules [1], optoelectrical Sisyphus cooling [2], and, most recently, sub-Doppler cooling [3] all cooling to temperatures in this range. This opens exciting prospects for applications ranging from precision measurements and ultracold chemistry to quantum information processing and investigation of strongly interacting molecular quantum gases.

I will present our techniques for generating molecule ensembles at cold and ultracold temperatures. 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 (H2CO), produces a record large ensemble of roughly 300,000 molecules below 1mK. Based on these achievements, we are currently working on first applications, including investigation of cold molecule-molecule collisions and precision spectroscopy on a mm-wave formaldehyde transition with kHz linewidths.

[1] Norrgard et al., PRL 116 063004 (2016)

[2] Prehn et al., PRL 116 063005 (2016)

[3] Truppe et al., arXiv:1703.00580 [physics.atom-ph] (2017)

Tuesday, July 11, 2017, 1:00 p.m., HS II,
Physics high rise, Hermann-Herder-Str. 3

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