

**Plenary Talk**

PV XI Fri 9:45 E415

**Quantum Simulation using Ultracold Atoms and Molecules**

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40 years ago, Richard Feynman outlined his vision of a quantum simulator for carrying out complex calculations of physical problems. Today, his dream has become a reality and a highly active field of research across different platforms. In my talk, I will delineate how ultracold atoms in optical lattices started this vibrant and interdisciplinary research field 20 years ago and now allow probing quantum phases in- and out-of-equilibrium with fundamentally new tools and single parti-

cle resolution. Ultracold polar molecules allow to significantly extend the simulation capabilities due to their more complex internal structure and strong dipolar interactions. So far, however, efficient and general techniques to cool them to quantum degeneracy have remained out of reach. In the talk, I will discuss how microwave shielding provides an efficient general solution that allows to cool three-dimensional bulk samples of polar molecules to deep quantum degeneracy as well as to provide a handle on controlling their scattering properties using novel 'field-linked' resonances. Realizing such full control over polar molecules promises to harness their full potential for quantum simulations.