Physics Colloqium

Physics Faculty Search Candidate

Daniel McCarron

Thursday, January 26th at
4:10 pm - Lewis Lab 316
Refreshments at 3:45

Daniel McCarron

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Ultracold Polar Molecules: Production Methods and Scientific Applications

Laser cooling and trapping have revolutionized atomic physics, enabling a huge range of advances in science and technology, from Bose-Einstein condensates and matter-wave interferometry to improved atomic clocks. In recent years, it has become clear that methods to produce ultracold molecules would have a similarly broad scientific impact, with proposed applications in basic science and technology. Compared to atoms, the rich internal structures of polar molecules hold promise for allowing important advances in ultracold chemistry, quantum simulation, quantum computation, and precision measurements. But the same structure that makes polar molecules interesting also makes them significantly more challenging to cool and trap than atomic species. Thus far, the most successful methods for producing ultracold polar molecules have harnessed the maturity of techniques for cooling and trapping certain atomic species; first, atoms are laser cooled and trapped, and then molecules are assembled out of these ultracold atoms. More recently, however, there have been tremendous advances in applying laser cooling and trapping techniques to molecules directly. This new and general approach is applicable to a wide variety of molecular species with a range of properties and internal structures well-suited to the growing list of proposed applications.