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Laser-cooled molecules for quantum science and ultracold chemistry DANIEL MCCARRON, University of Connecticut — Molecular laser cooling and trapping offers a general technique to produce ultracold molecules and is applicable to a variety of species with different internal structures. This generality is well-suited to the growing list of proposed applications for ultracold molecules, from time-resolved quantum simulations to ultracold organic chemistry. However, current limitations prevent the detection and manipulation of the necessary molecule-molecule interactions in laser-cooled samples. The key barrier is inefficient trap loading, which limits the densities achieved in molecular magneto-optical traps. Here we describe two complementary experiments designed to remove this barrier and realize large, dense samples of ultracold molecules. The first targets polar molecules with closed electronic shells, such as AlCl, which have strong optical transitions ideal for trap loading and weak transitions for laser cooling towards 1 μK. The second targets light, chemically relevant species with blue optical transitions such as CH and CN. These species can give access to increased optical forces and short slowing distances thanks to their high recoil velocities. We will discuss the advantages and challenges associated with laser cooling these new species and present an update on experimental progress.

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