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New species and new techniques for molecular laser cooling experiments JAMIE SHAW, LUCAS RAILING, DANIEL MCCARRON, University of Connecticut — The extension of laser cooling and trapping techniques to molecules promises access to new research directions from ultracold chemistry and quantum simulation to improved precision measurements. Recent progress laser cooling molecules has produced multiple diatomic species in the ultracold regime. To-date all of these laser-cooled species have an unpaired electronic spin and occupy $^2\Sigma^+$ ground states. Here we present a new experiment to laser-cool and trap molecules with closed electronic shells that occupy $^1\Sigma^+$ ground states. These molecules offer favorable properties for laser cooling including a lack of spin-rotation structure and the presence of both strong and weak optical transitions. These properties will support simplified laser-cooling schemes, increased optical forces for efficient trap loading and the ability to laser cool towards 1 μK. We project that these advances will allow the direct production of large, dense samples of ultracold molecules for studies that manipulate molecule-molecule interactions. Our results will include a new cryogenic source capable of producing bright, quasi-continuous beams of cold and slow molecules and a fluorescence detection scheme that is immune to the scattered light background that limits current sensitivities.

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