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Ultracold Molecules in Lattices for Metrology and Precision Measurements GAEL REINAUDI, CHRIS OSBORN, MICKEY MCDONALD, DILI WANG, TANYA ZELEVINSKY, Columbia University — Ultracold diatomic molecules offer exciting possibilities for studies of novel states of matter, quantum information, and metrology. Two-electron-atom based molecules are particularly promising for precision measurements, such as molecular time metrology and variations of the proton-electron mass ratio. We present an experimental setup that allows for the photoassociation, in an optical lattice, of strontium atoms into molecules using the narrow singlet-triplet transitions. We feature newly observed two-photon photoassociation to deeply bound molecular levels, as well as the study of the lifetime of such molecules in lattices, which is a determining factor concerning the practical use of this system. Other characteristics of our setup are presented, such as a computer controlled permanent-magnet Zeeman slower optimized with a genetic algorithm.

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