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Old and new physics with ultracold $^{88}Sr_2$ molecules in optical lattices GAEL REINAUDI, MICKEY MCDONALD, BART H. MCGUYER, CHRISTOPHER B. OSBORN, TANYA ZELEVINSKY, Columbia University — Ultracold molecules provide an exciting testing ground for studies of fundamental interactions, new states of matter, and metrology. Diatomic molecules based on two-electron atoms are especially suitable for precise tests of interatomic interactions, molecular QED, electron-proton mass ratio variations, and deviations from Newtonian gravity at the nanoscale. We describe the efficient production of $^{88}Sr_2$ in an optical lattice, detection via ultracold optical fragmentation, and studies of molecular loss processes. We also present high-Q spectra of the molecules in magnetic fields that point to possible QED sensitivity as well as to strong-coupling effects that are not yet well understood. Current and future work made possible by this new type of long-lived molecule is discussed.

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