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Precision Measurements with a Molecular Clock[1] ANDREW GRIER, MICKEY MCDONALD, BART MCGUYER, GEOFFREY IWATA, Department of Physics, Columbia University, FLORIAN APFELBECK, Faculty of Physics, Ludwig Maximilian University of Munich, MARCO TARALLO, TANYA ZELEVINSKY, Department of Physics, Columbia University — We report on recent results obtained with photoassociated Sr2 molecules confined in a lattice. Sr2 has a range of electronically excited bound states which are readily accessible with optical wavelengths using the narrow 1S0-¿3P1 intercombination line. As in Nat. Phys. 11, 32, we measure the lifetimes of the narrow, deeply-bound subradiant states in the 1g (1S0+3P1 dissociative limit) potential, allowing for coherent control of molecules and a comparison with theoretical predictions of the lifetimes and transition strengths of these states. Next, we study ultracold photodissociation of Sr2 molecules through abortion of one and two photons near the atomic intercombination line. This allows us to observe the vector character of transition elements through the angular dissociation pattern and to directly measure barrier heights in the excited state potentials. Finally, as shown in PRL 114, 023001, we demonstrate that in a non-magic lattice, a narrow transition can be used to measure the trapped gas temperature through the linewidth of the spectral feature corresponding to the carrier transitions. We use this technique to measure the temperature of Sr2 molecules to 10x higher precision than with standard techniques. We discuss future prospects with this molecular lattice clock.

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