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**Spectroscopic Determination of Strontium Scattering Lengths** PASCAL MICKELSON, S.B. NAGEL, A.D. SAENZ, Y.N. MARTINEZ, Y.C. CHEN, T.C. KILLIAN, Rice University, P. PELLEGRINI, R. COTE, University of Connecticut — We perform photoassociative spectroscopy (PAS) of strontium in order to determine the scattering lengths of the most abundant bosonic isotopes, $^{88}$Sr and $^{86}$Sr. Unlike other PAS experiments, photoassociation occurs directly in a magneto-optical trap operating on the narrow intercombination line at 689 nm. A laser red-detuned from the principal atomic transition at 461 nm by as much as 1400 GHz induces the photoassociation of ground state atoms into excited molecular states. From variation in the strength of these transitions, we pinpoint the location of a node in the ground state wave function of $^{86}$Sr, the first such measurement for this isotope. In turn, we extract the ground state scattering lengths for both isotopes. The large positive scattering length of $^{86}$Sr and the small scattering length of $^{88}$Sr mean that achieving Bose-Einstein condensation of strontium, the main motivation for this work, should be more straight-forward for $^{86}$Sr than for $^{88}$Sr.

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