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Lifetimes of strontium ultralong-range Rydberg molecules in a dense BEC[1] S.K. KANUNGO, J.D. WHALEN, Y. LU, F.B. DUNNING, T.C. KILLIAN, Rice University — A Rydberg molecule, formed by the binding of one or more ground-state atoms to a Rydberg atom, can be destroyed by interactions involving the Rydberg core ion and a neutral ground-state atom within the Rydberg electron orbit. Previous studies with rubidium and strontium have measured such loss rates in dense gases($\sim 10^{14}\text{cm}^{-3}$) and have attributed the destruction to two main processes: associative ionization resulting in a Rb_2^+/Sr_2^+ ion formation and dissociation due to L-changing collisions[1,2]. Short lifetimes($\sim 1\mu$s) were measured at low principal quantum numbers (n) for both Rb and Sr, whereas an increased lifetime($\sim 10\mu$s) was reported at high n($\sim$140) for Rb. This behavior in Rb was attributed to the presence of a p-wave shape resonance in e-Rb scattering. Here we present a study of the lifetime of Sr Rydberg molecules (Sr does not possess a p-wave shape resonance) in a dense BEC by monitoring the evolution of the Rydberg population using field ionization. The total decay rate and the competition between two main destruction channels is investigated for different n, $49 \leq n \leq 150$, and BEC densities, $0.8 \times 10^{14}\text{cm}^{-3} \leq \rho \leq 3 \times 10^{14}\text{cm}^{-3}$. [1] Phys. Rev. A 96, 042702(2017), [2] Phys. Rev. X 6, 031020(2016).

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