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Lifetimes of Ultralong-range Strontium Rydberg Molecules in a Dense BEC[1] J. D. WHALEN, F. CAMARGO, R. DING, T. C. KILLIAN, F. B. DUNNING, Rice University, J. PEREZ-RIOS, Purdue University, S. YOSHIDA, J. BURGDORFER, Vienna University of Technology — Ultralong-range Rydberg molecules created in a dense BEC can be used to explore collective many-body phenomena such as the creation of polarons. The atom densities in a BEC, however, are such that even for moderate values of n, $n > 50$, the electron orbit can enclose tens to hundreds of ground-state atoms. Collisional destruction therefore becomes important and can limit the molecular lifetimes. Measurements of the loss of Rydberg molecules with $n = 49$, 60, and 72 excited in a BEC of ^{84}Sr with a peak density of 4×10^{14} cm^{-3} reveal large loss rates of $1 - 3 \times 10^5$ s^{-1}. This loss is attributed to two mechanisms: the formation of Sr^{2+} molecules through associative ionization, and ℓ-changing reactions involving the Rydberg electron, with associative ionization being dominant. Collisional loss limits the time available to explore collective effects and possible techniques to increase this time are being examined.

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