Long-range Rydberg-Rydberg interactions at very-high \( n \)\(^1\) R G Fields, R Brienza, F B Dunning, Rice Univ, S Yoshida, J Burgdorfer, Vienna University of Technology — Excitation of very-high-\( n \) strontium Rydberg atoms under blockade conditions in an atomic beam provides an opportunity to study strongly-coupled Rydberg-Rydberg systems under controlled conditions. In the present work, blockade is exploited to create a string of Rydberg atoms with approximately equal initial separations. Sudden application of an electric field “step” is then used to create Stark wave packets whose subsequent time evolution is monitored through ionization induced by a pulsed electric field. Measurements of the number of surviving Rydberg atoms reveal pronounced Stark quantum beats. Preliminary comparisons of the quantum beat behavior for single and multiple Rydberg atoms indicate that Rydberg-Rydberg interactions lead to dephasing and a reduction in the amplitude of the (collective) beats. The mechanisms responsible for this are being examined through further experimental studies and through theoretical analysis.

\(^1\)Research supported by the NSF, the Welch Foundation, and the FWF (Austria)