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The Atomic Chameleons: Rydberg Wavepackets[1]

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The ability to prepare Rydberg electrons in well-defined coherent superpositions and measure time-dependent changes in their quantum states allows one to take advantage of their exaggerated properties to explore a variety of phenomena. For example, we are currently using Rydberg wavepackets to investigate schemes for suppressing quantum decoherence in single-electron systems as well as for probing and controlling electron correlation in two-electron atoms. In the former case, we have successfully used time-dependent fields to decouple Rydberg atoms from a noisy environment, essentially eliminating wavepacket decoherence. In the latter experiments, we employ double Rydberg wavepackets to study controlled, strong-field, non-sequential double ionization in a previously unexplored regime. Specifically, we measure double ionization probability as a function of the energies and radial positions of two atomic electrons at the instant of their exposure to a strong, impulsive, half-cycle electric field. We are examining the possibilities for using double ionization as a probe of time-dependent electron correlation in these systems.

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