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Soft x-ray driven femtosecond dynamics of ionic Rydberg states in N₂¹ ETIENNE GAGNON, ARVINDER S. SANDHU, JILA, University of Colorado at Boulder, Boulder Co 80309, PREDRAG RANITOVIC, C. LEWIS COCKE, J. R. MacDonald Lab, Physics Department, Kansas State University, Manhattan Ks 66506, HENRY C. KAPTEYN, MARGARET M. MURNANE, JILA, University of Colorado at Boulder, Boulder Co 80309 — We present the first direct observation of molecular dynamics initiated by a EUV pulse. A novel EUV pump- IR probe technique is used to observe these dynamics. The EUV pulse, with $h(\nu) = 42$ eV, launches molecular nitrogen into highly-excited (N₂)₂⁺ core Rydberg states, the dynamics of which are previously unexplored. We use a time-delayed infrared pulse to promote the wavepacket from the Rydberg state to a dissociative (N₂)₂⁺ state via multiphoton ionization. The kinetic energy release of the N⁺/N⁺ channel is obtained as function of time delay. Having identified the final (N₂)₂⁺ state, we extract the potential energy curve corresponding to the evolving Rydberg state. The Rydberg state initially behaves the same as the (N₂)₂⁺ state. As the internuclear distance increases, we observe a fast decrease in the kinetic energy release on the time scale of 100 fs, corresponding to a transition from the molecular Rydberg state to N⁺ and N fragments.

¹Soft x-ray driven femtosecond dynamics of ionic Rydberg states in N₂

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