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Revisiting molecular ionization: Does a molecule like to share?[1]
C.B. MADSEN, B.D. ESRY, J.R. Macdonald Laboratory, Department of Physics, Kansas State University — The ever-increasing detail obtained in strong-field experiments calls for a deeper understanding of the laser-molecule interaction. For instance, recent measurements reported in PRL **107**, 143004 (2011) reveal a limitation in understanding strong-field ionization dynamics in terms of the strong-field approximation. We have addressed the question of how the electron and the nuclei share the energy when H_2^+ breaks up in the presence of an intense IR field via the process: $H_2^+ + n\hbar\omega \rightarrow p + p + e^-$. Solving the time-dependent Schrödinger equation and calculating the ionization probability resolved as a function of the asymptotic electron energy and the nuclear kinetic energy release (KER) allow us to give an answer. The energy sharing is non-trivial and plays an important role in the prediction of, for instance, the KER. We also address the limitations of current understanding of molecular ionization by comparing to models like the strong-field approximation and the Floquet picture. Such benchmarking may be facilitated by XUV+IR pump-probe schemes and carrier-envelope-phase control that allow for time-resolved and spatial probing of the dynamics.

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