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A closer look at bond softening and Lochfrass effects

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About a decade ago, the so-called lochfrass effect was predicted that creates a vibrational wavepacket in the non-ionized neutral molecule upon strong-field ionization. It was shortly thereafter experimentally observed in molecular deuterium. However, as was pointed out in those works, the vibrational wavepacket could, in principle, also be generated by bond softening (the dressed-state description of stimulated Raman scattering). Using the surprising stability of the formed wavepacket it was possible to distinguish the two processes and to confirm lochfrass to be (predominantly) responsible. We have now revisited the processes in order to investigate the astonishing robustness of the two effects and why it was possible to distinguish the two processes by the absolute phase of the wavepacket, despite the fact that the experiment used laser pulses with no control over the carrier-envelope phase. The result reveals that a much more general control mechanism is responsible that is expected to be an extremely robust and thus useful alternative for the standard generation of coherent wavepackets using light fields.

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