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Strong field physics revealed through time-domain spectroscopy¹

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Pump-probe spectroscopy is generally used to study molecular dynamics. Over the past few years, we have turned this around and used molecular dynamics to study strong field interactions with molecules, using time-domain pump-probe spectroscopy. Many strong field experiments are insensitive to the final state of the atom or molecule under study, although the final state contains important information about the strong field interaction. By studying the vibrational dynamics of the final state we can learn about the interaction of the strong laser field with a molecule. In this talk, I will review a number of our results, including the measurement of a previously inaccessible potential energy curve in iodine, the demonstration of inner-orbital ionization, the observation of a new form of coherent control which works better as the temperature increases, and the demonstration of vibrational cooling of molecules through strong-field ionization.

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