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Toward quantum controlled initiation of energetic materials MARGO GREENFIELD, SHAWN MCGRANE, JASON SCHARFF, KATHRYN BROWN, DAVID MOORE, Los Alamos National Laboratory, HERCULES TEAM — Successful quantum controlled initiation requires understanding the photochemical reactions that occur when time dependent electric fields interact with energetic materials. Steering the outcome of a chemical reaction with light requires optimally shaped ultrafast laser pulses to guide energy flow along desired reaction coordinate pathways. The ability to measure the complex photo-chemical dynamic molecular vibrations is key to not only understanding but controlling the photodecomposition mechanisms of energetic materials. We have successfully built a Femtosecond Stimulated Raman Spectroscopy (FSRS) system that works in tandem with our existing 400 nm broadband shaped pump (actinic pump) and 400-700 nm Transient Absorption (TA) probe experiment. This gives us a unique capability of photo-exciting energetic materials with an actinic shaped broadband femtosecond pump pulse and measuring the resulting dynamics simultaneously using FSRS and TA. The measured evolution of the TA and, more importantly, the vibrational spectrum during the photodecomposition transformation provides key structural data on the reaction mechanisms. We have tested our new capability on both energetic and non-energetic materials and have observed vibrational dynamic changes suggesting possible decomposition mechanisms.

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