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Control of molecular fragmentation using shaped femtosecond pulses MARCOS DANTUS, VADIM LOZOVOY, Michigan State University — The ability to tailor the excitation laser pulse by pulse shaping has inspired a number of scientist to search for special pulses that would be capable of inducing selective bond fragmentation or specific molecular rearrangements. This presentation will summarize results from a comprehensive look at the interaction of shaped laser pulses with para-nitrotoluene molecules. We have performed exhaustive experimental evaluation over very different pulse shaping strategies such as chirp, sinusoidal modulation, sinusoidal phase, binary phase, binary amplitude, binary phase and amplitude. For all these methods we recorded hundreds of mass spectra together with the integrated second harmonic generation (SHG) as an independent parameter related to pulse complexity or pulse duration. As expected, the integrated SHG of a given laser pulse correlates linearly with the total amount of ions detected. We were surprised, however, that the fragmentation patterns observed varied simply and predictably with the integrated SHG regardless of pulse shaping strategy. This implies that the integrated SHG fraction compared to a transform limited pulse is an excellent predictor of the fragmentation pattern for a given molecule. The implications of our findings for this and other molecules will be discussed from the fundamental point of view of bond selective chemistry. The development of applications for molecular recognition will also be discussed.

Marcos Dantus
Michigan State University

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