# Coherent control of selective bond breaking in model peptides

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The control of photo physical processes with judiciously tailored intense femtosecond laser pulses is a cutting edge topic in modern laser science and might pave the way to optically controlled organic chemistry. In this contribution we report on pulse-shaping experiments using closed-loop, optimal control feedback for selective bond breaking in amino acid complexes, such as Ac-Phe-NHMe. This molecule contains a -CO-NH-CHR-CO- moiety, the key structural element of peptides and may be regarded as a "model peptide".

We show that strong-field control strategies making use of coherent properties of the electromagnetic wave allow one to cleave the strong acyl-N ("peptide") bond in the molecular system preferentially, while keeping other more labile bonds intact [1]. A detailed analysis of the spectral content of the optimal pulse sequence indicates that the $S_1$ state acts as an isomer selective "doorway" in the highly non-linear excitation and fragmentation process.

Studies on different chromophores, such as Phenylalanine and Alanine, while keeping the backbone structure unchanged elucidates the effect of the excitation dynamics on the relaxation pathways [2]. The observation of protonated species in the corresponding mass spectra indicates that optimal control of ultrafast laser pulses may even be useful to study intramolecular reactions such as hydrogen- or proton-transfer in particular cases. This opens new perspectives for biophysical and biochemical research, since these photochemical reactions are suggested to explain e.g. photo stability of DNA.

[1] T. Laarmann, I. Shchatsinin, P. Singh, N. Zhavoronkov, M. Gerhards, C.P. Schulz, I.V. Hertel, J. Chem. Phys. **127**, 201101 (2007).

[2] T. Laarmann, I. Shchatsinin, P. Singh, N. Zhavoronkov, C.P. Schulz, I.V. Hertel, J. Phys. B **41**, 074005 (2008).