



The Center for
Light Matter Interaction
Tel Aviv University

LMI Seminar:

Ultrafast laser engineering, physics, and chemistry

Prof. Marcos Dantus

MSU Foundation Professor, University Distinguished Professor
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Sunday January 22th, 2022
11:00-12:00

Light refreshments and drinks will be served at 10:30

**Auditorium 011, Engineering Classroom Building, Faculty of
Engineering, Tel-Aviv University**

Abstract: A persistent challenge in the generation of ultrafast laser pulses is robust pulse characterization and compression of broadband sources. I will present a method that solves this problem [1], and its latest refinements. The rest of the talk will focus on chemical processes following electron ionization relevant to astrochemistry and mass spectrometry. Present challenges in this field are fragmentation pattern prediction and molecular structure determination from the fragmentation pattern of an unknown molecule. Femtosecond time-resolved studies of these processes would help understand the competition between intramolecular energy flow and bond-breaking processes. I will explain how we use ultrafast electron recollision, responsible for attosecond pulse generation, to mimic the electron ionization process that takes place in a conventional mass spectrometer [2]. This approach allows us to obtain femtosecond reaction dynamics and answer the question of intramolecular energy flow. As an example, I will present results on the roaming mechanism responsible for H₃⁺ formation from organic molecules [3].

[1] Y. Coello, V. V. Lozovoy, T. C. Gunaratne, B. Xu, I. Borukhovich, C. -h. Tseng, T. Weinacht, and M. Dantus, "Interference without an interferometer: a different approach to measuring, compressing, and shaping ultrashort laser pulses," J. Opt. Soc. Am. B 25, A140-A150 (2008).

[2] B. Jochim, L. Dejesus, M. Dantus, "Ultrafast disruptive probing: simultaneously keeping track of tens of reaction pathways," Rev. Sci. Instr. 93, 033003 (2022).

[3] N. Ekanayake, T. Severt, M. Nairat, N. P. Weingartz, B. M. Farris, B. Kaderiya, P. Feizollah, B. Jochim, F. Ziaee, K. Borne, K. Raju P., K. D. Carnes, D. Rolles, A. Rudenko, B. G. Levine, J. E. Jackson, I. Ben-Itzhak, and M. Dantus, "H₂ roaming chemistry and the formation of H₃⁺ from organic molecules in strong laser fields," Nat. Commun. 9, 5186 (2018).