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INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

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IAPME Seminar

Celebrating the 45th Anniversary of the University of Macau: Ultrahigh Spatiotemporal Dynamics at the Nanoscale

2 March 2026

Prof. Dongping ZHONG
Shanghai Jiao Tong University

Venue: N23-4018
Time: 10:30 - 11:30
Hosted by: Prof. Handong SUN

Abstract

Irreversible ultrafast events are prevalent in nature yet capturing them in real time poses significant challenges. Traditional single-shot imaging technologies, which utilize single optical pump and single delayed electron probe, offer high spatiotemporal resolution but fail to capture the entire dynamic evolutions. Here, we introduce a novel imaging method employing single optical pump and delayed multiple electron probes. This approach, facilitated by an innovative deflector in ultrafast electron microscopy, enables the acquisition of nine frames per exposure, paving the way for statistical and quantitative analysis. We have developed an algorithm that corrects frame-by-frame distortions, realizing a cross-correlation enhancement of ~26%. Achieving ~12 nm and 20 ns resolution, our method allows for the comprehensive visualization of laser-induced behaviors such as in Au nanoparticles, including merging, jumping, and collision processes. Our results demonstrate the capability of this multiframe imaging technique to document irreversible processes across materials science and biology with unprecedented nanometer-nanosecond precision.

Biography

Prof. Dongping ZHONG received his B.S. in laser physics from Huazhong University of Science and Technology in China and his Ph.D. in chemical physics from California Institute of Technology in 1999 under the late Prof. Ahmed H. ZEWAIL. For his Ph.D. work, Prof. Zhong received the Herbert Newby McCoy Award and the Milton and Francis Clauser Doctoral Prize from Caltech. He continued his postdoctoral research in the same group with focus on protein dynamics. In 2002, he joined The Ohio State University as an Assistant Professor and was promptly promoted as Robert Smith Professor of Physics and Professor of Chemistry and Biochemistry. He is the Packard Fellow, Sloan Fellow, Camille Dreyfus Teacher-Scholar, Guggenheim Fellow, APS Fellow, AAAS Fellow, as well as the recipient of the NSF CAREER award and the Outstanding Young Research award from the International Organization of Chinese Physicists and Astronomers. He was the international Jury member in physical science for the L'Oréal-UNESCO awards for"Women in Science."His early work on femtochemistry and recent work on the enzyme dynamics have been cited in the press release and Noble lecture of two Nobel Prizes (1999 and 2015). Recently, he moved to China and now is a Chair Professor in Shanghai Jiao Tong University. His research interests focus on protein and nanomaterials dynamics using ultrafast photons and electrons.