4D electron microscopy and its applications in non-equilibrium dynamics

Xuewen Fu[1]

[1.] Ultrafast Electron Microscopy Laboratory, The MOE Key Laboratory of Weak-Light Nonlinear Photonics, School of Physics, Nankai University, Tianjin 300071, China.

Four-dimensional electron microscopy (4D-EM), which enables the direct observation of transient structures, morphologies and even carrier transport of materials in real time and space, has attracted increasing interest to the research community due to its powerful capability in the interdisciplines of physics, chemistry, material science, and biology [1-2]. In this presentation, I will firstly give a brief introduction of the development of 4D-EM and the state-of-the-art of 4D-EM and its applications in scientific research. Then, I will present some of our recent developments in situ 4D EM technologies and their applications, including ultrafast cathodoluminescence, liquid-phase 4D EM, laser-free 4D EM and two-color near field 4D EM etc. [3-5]. Following that, I will talk about our recent progress in the development of a new generation 4D-EM based on a 200kV field emission transmission electron microscope (Thermofisher Talos 200i) and its preliminary application in imaging surface plasmon dynamics [6]. The high versatility and sensitivity of our new generation 4D-EM would allow capturing the dynamics of a wide range of nanoscale materials with high spatiotemporal resolution.

References

[1] A. Yurtsever et al., Science 326, 708-712 (2009).
[2] B. Barwick et al., Nature 462, 902-906 (2009)
[3] X. Fu et al., Science 355, 494-498 (2017).
[4] X. Fu et al., ACS nano 15 (4), 6801-6810 (2021).
[5] X. Fu et al., Nature Communications 11(1), 5770 (2020).
[6] X. Fu et al., Nano Lett. 22, 2009−2015 (2022).