



Contribution ID: 1870 Contribution code: TUODC1

Type: **Contributed Oral Presentation**

Megaelectron-Volt ultrafast electron microscope – the future of electron imaging

Tuesday, 9 May 2023 15:30 (20 minutes)

Aberration correction electron optics and cold field-emission electron source made the transmission electron microscope (TEM) a popular tool to image atomic and nano-scale objects. Cryogenic electron microscopy (Cryo-EM) revolutionized the bio-structure science, and recently it is explored to investigate radiation-sensitive battery and energy materials. But non-physiological environments, sample damage and electron beam induced sample movement greatly limit the science impact of both TEM and Cryo-EM. To address those challenges, we propose to develop ultrafast electron microscope based on megaelectron electron beams (MeV-UEM). The development of high-brightness electron sources made it feasible to explore megaelectronvolt electrons for Ultrafast Electron diffraction and Microscope (MeV-UED/UEM) [1-2]. MeV-UED had broad and transformative impact on ultrafast science, such as the first 2-D materials ultrafast structure dynamics, light-induced transient states, molecular movies of canonical interception & ring-opening, and the first hydrogen bond structure dynamics in liquid water [3]. The proposed MeV-UEM will be capable of single-shot imaging with atomic spatial resolution (0.3 nm) and sub-nanosecond temporal resolution. We will present the plan of employing accelerator technologies, such as high-brightness MeV electron source, novel electron optics and high field magnet, to realize the MeV-UEM.

Funding Agency

Footnotes

1. X.J. Wang et al, Phys. Rev. E , 54, No.4, R3121 -3124 (1996).
2. X.J. Wang et al, Proceedings of the 2003 Particle Accelerator Conference, 2003, pp. 420-422 Vol.1, doi: 10.1109/PAC.2003.1288940.
3. J. Yang, X.J. Wang et al., Nature 596, 531–535 (2021). <https://doi.org/10.1038/s41586-021-03793-9>.

I have read and accept the Privacy Policy Statement

Yes

Primary author: WANG, Xijie (SLAC National Accelerator Laboratory)

Presenter: WANG, Xijie (SLAC National Accelerator Laboratory)

Session Classification: MC02.1 - Photon Sources and Electron Accelerators (Contributed)

Track Classification: MC3: Novel Particle Sources and Acceleration Techniques: MC3.A16: Advanced Concepts