Contribution ID: **81** Type: **Contributed oral**

Application of Low-Emittance Electron Beams for MeV UED

Wednesday, June 21, 2023 12:35 PM (20 minutes)

Mega-electronvolt ultrafast electron diffraction (MeV-UED) is a complementary tool to X-ray based instruments that has enabled ground-breaking studies in condensed matter physics and chemical science. A significant opportunity exists for MeV-UED beyond current instrument capabilities in quantum materials, microelectronics and photo-chemical research. Further improvement in MeV-UED transverse emittance would allow access to longer-range electron correlations in quantum materials and to probe micron-sized homogeneous regions within complex heterogeneous materials. To broaden the scientific opportunities, improved instrument performance of MeV UED has been heavily requested. We discuss plans at the SLAC MeV-UED facility to enable substantial near-term improvements in beam brightness, data acquisition rate, and temporal and momentum-space resolution.

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Session Classification: Ultrafast electron probes