Ultrafast probing of transient electric fields from optical field ionized plasmas using picosecond electron deflectometry ZHAOHAN HE, JOHN NEES, BIXUE HOU, KARL KRUSHELNICK, ALEC THOMAS, Univ of Michigan - Ann Arbor — Femtosecond bunches of electrons with relativistic to ultra-relativistic energies can be robustly produced in laser plasma wakefield accelerators (LWFA). Scaling the electron energy down to sub-relativistic and MeV level using a millijoule laser system will make such electron source a promising candidate for ultrafast electron diffraction (UED) the applications due to the intrinsic short bunch duration and perfect synchronization with optical pump. Electrons with sub-relativistic (~100 keV) energies can be used to probe transient electric field generated in laser plasmas with very high sensitivity. In a proof-of-principle experiment, we measured field evolution from plasma produced by focusing femtosecond laser pulses into a gas jet at intensities up to $10^{17}$ W/cm$^2$. Due to the energy spread in laser plasma generated electrons, dipole magnets are used to record a streaked electron image such that the temporal evolution can be mapped in a single shot. This technique allows for probing irreversible processes such as melting of crystalline samples.

Zhaohan He
Univ of Michigan - Ann Arbor