Strong field photoemission of electrons has been extensively studied in the past [1, 2]. Enabled by the development of high-intensity THz sources, THz-field-driven emission from a nanotip [3] up to fC bunch charge [4], and with pC charge from an antenna structure [5] have been demonstrated. Field-driven electron emission is a quantum mechanical effect, which involves the tunnelling of electrons into vacuum. The high electric field narrows the potential barrier at the metal-vacuum interface sufficiently for the electrons to have a significant probability of tunnelling from the solid into the vacuum.

Here, we present simulation results in support of an experimental study on electron emission from a plane gold surface irradiated by intense single-cycle THz pulses with 0.35 THz mean frequency, focused to a peak field strength up to $3 \times 10^5$ V/cm (corresponding to a Keldysh parameter of $\gamma \approx 0.4$). This research investigation demonstrates the electron emission from a metal surface induced by low-frequency high-field THz pulses. Flipping the polarity of the THz pulses resulted in a significantly different current signal. To understand the microscopic origin of THz field driven photoemission from the gold surface, a simple two-step model [3] was adopted to study the emission and acceleration of electrons.

References