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Application of a novel high brightness photogun for MeV ultrafast electron diffraction

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MeV ultrafast electron diffraction has become a new frontier for the study of molecular dynamics. With the temporal resolution of MeV-UED being limited by the electron bunch length at the target, electron sources used for this technique are becoming ever more intricate in the the push for shorter bunches length. However, moving to these complex setups makes them less feasible in a small-scale setting, such as universities, where keV-UED setups have become common place. In this paper, we use a novel traveling-wave rf photogun without any additional bunch compressor to generate ultra-short electron pulses whose lengths rival that of the most intricate magnetic or ballistic compression schemes. The broadband nature of the TW device allows for unique operation schemes that combines significant acceleration and compression all within the TW photogun. Such a device, when combined with state-of-the-art synchronization systems and lasers will be demonstrated to cross the so-called '50-fs time-resolution barrier'and push towards the femtosecond regime.

Footnotes

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