Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Tunnel Ionization in Tightly Focused Laser Fields at Intensity up to 3 x 10^{23} W/cm^{21} ANDREW YANDOW, TODD DITMIRE, Center for High Energy Density Science, University of Texas, Austin, TX 78712 — Experimental tests of the Ammosov-Delone-Krainov (ADK) tunnel ionization model above 10^{20} W/cm^2 should provide insight into relativistic effects in the tunneling process. We present simulations of the ion yields, ion dynamics, and electron dynamics in near-infrared laser fields with intensities ranging from 10^{20} W/cm^2 to 3 x 10^{23} W/cm^2 and how our results will influence the design of future experiments. We included the effects of the $f/1$ focal geometry required to reach 3 x 10^{23} W/cm^2 in the near future, incorporating nonparaxial corrections to the laser fields up to fifth order in the diffraction angle. Simulations of the ion energy gained from the ion-laser interaction demonstrate the need to develop new ionization yield measurement techniques, as the Wiley-McLaren time-of-flight methods used previously have insufficient energy resolution when laser intensity exceeds 10^{21} W/cm^2. When considering the ionization of Kr^{35+} at 3 x 10^{23} W/cm^2, we find that the ponderomotive expulsion of ions from the laser focus will decrease the ionization yield. The highly charged krypton ions and their above-threshold ionization electrons can be accelerated to energies above 2 MeV/nucleon and 1.4 GeV, respectively.

[1]This work was supported by the Air Force Office of Scientific Research (AFOSR) award numbers FA9550-14-1-0045 and FA9550-17-1-0264, as well as by the UT Physics Focht Fellowship.

Andrew Yandow
Center for High Energy Density Science, University of Texas, Austin, TX 78712

Date submitted: 03 Jul 2019 Electronic form version 1.4