Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Using high-field ionization for laser intensity calibration MARCELO CIAPPINA, ELI-Beamlines, Czech Academy of Sciences, Prague, Czech Republic, SERGEY POPRUZHENKO, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany, SERGEI BULANOV, ELI-Beamlines, Czech Academy of Sciences, Prague, Czech Republic, TODD DITMIRE, Center for High Energy Density Science, University of Texas, Texas, USA, GEORG KORN, STEFAN WEBER, ELI-Beamlines, Czech Academy of Sciences, Prague, Czech Republic
— We present an approach for direct measurement of ultrahigh laser intensities in the range $10^{20} - 10^{24}$ W/cm^2. The method is based on the use of multiple sequential tunneling ionization of heavy atoms with adequately high ionization potentials. We show that, due to the highly nonlinear dependence of tunneling ionization rates on the electromagnetic field strength, an off-set in the charge distribution of ions appears to be clearly sensitive to the peak value of intensity in the laser focus. Based on the tunnel-ionization mechanism, a simple analytic theory helps estimating the maximal charge state produced at a given laser intensity Our theory also allows calculating qualitatively a distribution in charge states generated in different zones of the laser focus. These qualitative predictions are in excellent agreement with numerical simulations of the tunneling cascades, developed in the interaction of a short tightly focused laser pulse with low-density noble gas targets. The method could be particularly useful and of instrumental demand in view of the expected commissioning of several new laser facilities, capable of delivering ultra-powerful light pulses in the above mentioned domain of intensities.

Marcelo Ciappina
ELI-Beamlines, Czech Academy of Sciences

Date submitted: 28 Jan 2019 Electronic form version 1.4