Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Ion acceleration via TNSA near and beyond the relativistic transparency limit[1] DOUGLASS SCHUMACHER, Ohio State University, PATRICK POOLE, Lawrence Livermore National Laboratory, GINEVRA COCHRAN, CHRISTOPHER WILLIS, Ohio State University — Ultra-intense laser-based ion acceleration can proceed via several mechanisms whose fundamental operation and interplay with each other are still not well understood. The details of Relativistically Induced Transparency (RIT) and its impact on ultra-thin target acceleration are of interest for fundamental studies and to progress toward applications requiring controlled, high energy secondary radiation, e.g. hadron cancer therapy. Liquid crystal film targets formed in-situ with thickness control between 10 nm and > 50 μm uniquely allow study of how ion acceleration varies with target thickness. Several recent studies have investigated Target Normal Sheath Acceleration (TNSA) down to the thickness at which RIT occurs, with a wide range of laser conditions (energy, pulse duration, and contrast), using various ion and optical diagnostics to ascertain acceleration mechanisms and quality. Observation of target-normal directed ion acceleration enhancement at the RIT thickness onset will be discussed, including analysis of ion spatial and spectral features as well as particle-in-cell simulations investigating the underlying physical processes.

[1]This material is based upon work supported by the AFOSR under award number FA9550-14-1-0085, by the NNSA under DE-NA0003107, and by computing time from the Ohio Supercomputer Center.

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Date submitted: 14 Jul 2017 Electronic form version 1.4