Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Paramount Deuteron Acceleration Using High-Intensity Short Laser Pulses F. YU, A. RAYMOND, C. ZULICK, L. WILLINGALE, K. KRUSHELNICK, A. MAKSIMCHUK, Center for Ultrafast Optical Science, University of Michigan, Ann Arbor, G. PETROV, J. DAVIS, US Naval Research Laboratory, Washington DC — It has long been a challenge to efficiently generate laser-driven ion beams having none-proton ions as the dominant species since protons are generally present as contamination layers on the target surface. During recent experiments at the University of Michigan, ion beams composed mainly of deuterons were produced with only a small relative number of protons and oxygen ions. The experiments were performed with the 400 fs, 20 TW T-cubed laser which has focused intensity up to $4*10^{19}$ W/cm^2 at 1053 nm and ASE intensity contrast of 10^{-7}. The accelerated deuterons originate from liquid deuterium oxide deposited on both the front and rear surfaces of a cryogenically cooled Cu target (normally at -160C) by spraying $\sim$50 microliters of heavy water from 2 nozzles in the vicinity of the target's front and rear. The ion beams had a Maxwellian spectrum with maximum energy of 8 MeV for deuterons and 10 MeV for protons. Using a Thomson parabola ion spectrometer system combined with CR39 indicated that the forward-propagating deuteron beam had about 10^{12} ions per steradian (integrated over spectrum). The FWHM of the beam was 20 degrees, ideal for applications involving neutron generation and isotope activation.

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Date submitted: 18 Jul 2012 Electronic form version 1.4