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Numerical Investigation of Droplet-Based Heavy-Ion Generation[1]

P. MESSMER, D.L. BRUHWILER, D.A. DIMITROV, C. NIETER, J.R. CARY[2], Tech-X Corporation, M. RICHARDSON, University of Central Florida — Basic research in nuclear physics and astrophysics requires the acceleration and collision of highly charged rare isotopes. Conventional ion source technology based on electron cyclotron resonance (ECR) cannot produce the necessary beam current for many of these rare isotopes. Laser ionization of micron-sized doped water droplets generates plasmas which can produce accelerated ions. The droplet and laser parameters can be tuned to ionize a precisely controlled number of heavy atoms. Laser-droplet plasmas therefore seem an attractive enhancement for the heavy ion current in ECR sources. Here we present results of particle-in-cell (PIC) simulations of the interaction of a strong laser pulse with μm-sized droplets, using the plasma simulation code VORPAL[1]. The code features perfectly matched layer boundary condition which allows to avoid spurious reflections off the simulation domain walls. Droplet ionization is modeled using the quasi-static ADK tunneling ionization model implemented in the ionpack library[2]. The simulation parameters are chosen close to the experimental parameters.

[1] Nieter, C, Cary, J.R., J. Comp. Phys, 196(2), 448, 2004.
[2] http://www.txcorp.com/technologies/IONPACK/

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