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Computational modeling of multi-time scale laser-plasma interactions GREGORY NGIRMANG, The National Academies of Sciences, Engineering, and Medicine, Washington DC, JOHN MORRISON, KEVIN GEORGE, Innovative Scientific Solutions, Inc. Dayton OH, SCOTT FEISTER, Department of Computer Science, California State University Channel Islands, Camarillo CA, JOSEPH SNYDER, Miami University, Oxford OH, JOSEPH SMITH, Department of Physics, The Ohio State University, Columbus OH, KYLE FRISCHE, Innovative Scientific Solutions, Inc. Dayton OH, CHRIS ORBAN, ENAM CHOWDHURY, Department of Physics, The Ohio State University, Columbus OH, WILLIAM ROQUEMORE, Air Force Research Laboratory, Dayton OH — The interaction of intense, short-pulse lasers with matter necessarily couple physics across a range of timescales, from the femtosecond laser period to picosecond and nanosecond time scale physics of plasma evolution after initial irradiation. Realistic computational modeling of these interactions with traditional Particle-in-Cell (PIC) methods becomes prohibitively expensive to perform over timescales longer than a few picoseconds. A number of methods have been developed in order to model longer timescale physics by using multiple simulations, for different timescales[1]. Analogous to these efforts, I present a scripted framework in Python that enables the simulation of laser-plasma interactions from the femtosecond to the nanosecond by breaking a problem into timescale "stages", over which a PIC simulation models each timescale and acts as the initial condition of the following timescale, which requires the development of tool to handle "handoffs" between each stage. An example of simulation the irradiation of a 10 micron water droplet by a 5x1018 W/sq cm intensity laser in the LSP code with this framework is presented to illustrate the utility of this method to model multi-time scale physics. [1] Derek, et al. *Physics of Plasmas* 26.4 (2019): 043110

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