



**Michigan Institute for  
Plasma Science and  
Engineering Seminar**

## **Novel Particle-In-Cell Simulation Methods in Heavy-Ion Fusion Science and Related Fields**

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**Wednesday, 16 Sept. 2009 - 4:00 pm, Room 1005 EECS.  
(Refreshments will be served after seminar.)**



### **Abstract**

The Heavy Ion Fusion Science Virtual National Laboratory (HIFSVNL) is involved in the development of accelerators that can deliver beams suitable for high energy density experiments and implosion of inertial fusion capsules. For such studies, the HIFSVNL has developed original numerical methods for Particle-In-Cell (PIC) simulations including PIC with adaptive mesh refinement (AMR) [1] having a large-timestep mover for particles of arbitrary magnetized species [2]. These novel methods were implemented into the HIFSVNL flagship PIC code *Warp*. Following the introduction of new methods for simulation in boosted frames [3] and a new relativistic leapfrog particle pusher [4], *Warp* has recently been applied by researchers from the HIFSVNL to the high energy physics domain for the study of electron clouds, free electron lasers and laser wakefield accelerators. We will review these developments and discuss results from our investigations. This is joint work was performed jointly with R.H. Cohen [2], A. Friedman [2], D.P. Grote [2], W.M. Fawley [1], M.A. Furman [1], and C.R. Geddes [1].

[1] J.-L. Vay et al., *Phys. Plasmas* **11**, 5 (2004)

[2] R.H. Cohen et al., *Nucl. Inst. and Meth A* **577**, 52-57 (2007)

[3] J.-L. Vay, *Phys. Rev. Lett.* **98**, 130405 (2007)

[4] J.-L. Vay, *Phys. Plasmas* **15**, 056701 (2008)

### **About the Speaker:**

Dr. Jean-Luc Vay is a physicist in the Accelerator and Fusion Research Division at Lawrence Berkeley National Laboratory. He received his Ph.D. at the University of Paris, France. His research interests include the development of advanced numerical techniques and their application to heavy ion inertial fusion and particle accelerator studies.