



**Speaker:** Ari Stern  
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Friday, August 28, 2009  
4:00 PM  
TBA

**Title:** Implicit-explicit variational integration of highly oscillatory problems

**Abstract:**

We develop an implicit-explicit (IMEX) variational integrator, which is efficient, stable, and accurate for highly oscillatory mechanical systems, such as those encountered in molecular dynamics and biological physics. To do so, we split the Lagrangian into fast linear and slow nonlinear components, and approximate their respective contributions to the action integral using two different quadrature rules. The resulting variational method, which is implicit in the fast force and explicit in the slow force, is shown to avoid the spurious linear resonances that can destabilize fully explicit methods (such as multiple-time-stepping and trigonometric integrators), and yet requires only a linear solve, unlike fully implicit methods. Finally, it is shown that the IMEX integrator is able to capture important multiscale dynamical features resulting from the nonlinear fast-slow coupling, yet without requiring the fully-resolved fast oscillations to be computed.