1086-76-1823 **Mathieu Desbrun***, 1200 E. California Blvd, MS 305-16, Psadena, CA 91125. *Geometric, Variational Discretization of Continuum Theories.*

This talk will introduce geometric, variational discretizations of continuum theories arising in fluid dynamics, magnetohydrodynamics (MHD), and the dynamics of complex fluids. A central role in these discretizations is played by the geometric formulation of fluid dynamics as geodesics on the group of volume-preserving diffeomorphisms of the fluid domain. Inspired by this framework, we construct a finite-dimensional approximation to the diffeomorphism group and its Lie algebra, thereby permitting a variational temporal discretization of geodesics on the spatially discretized diffeomorphism group. The extension to MHD and complex fluid flow is then made through an appeal to the theory of Euler-Poincare systems with advection. Among the hallmarks of these new numerical methods are exact preservation of momenta arising from symmetries, automatic satisfaction of solenoidal constraints on vector fields, good long-term energy behavior, robustness with respect to the spatial and temporal resolution of the discretization, and applicability to irregular meshes. If time allows, we will also discuss some recent extensions, including spectral computations and high-resolution Lie derivatives. (Work in collaboration with Dmitry Pavlov, Evan Gawlik, Patrick Mullen, and Jerrold E. Marsden.) (Received September 24, 2012)