Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Navier-Stokes dynamics on a differential one-form TROY L. STORY, Morehouse College — After transforming the Navier-Stokes dynamic equation into a characteristic differential one-form on an odd-dimensional differentiable manifold, exterior calculus is used to construct a pair of differential equations and tangent vector(vortex vector) characteristic of Hamiltonian geometry. A solution to the Navier-Stokes dynamic equation is then obtained by solving this pair of equations for the position x^k and the conjugate to the position $\mathbf{b}_k$ as functions of time. The solution $\mathbf{b}_k$ is shown to be divergence-free by contracting the differential 3-form corresponding to the divergence of the gradient of the velocity with a triple of tangent vectors, implying constraints on two of the tangent vectors for the system. Analysis of the solution $\mathbf{b}_k$ shows it is bounded since it remains finite as $\left|x^k\right| \rightarrow \infty$, and is physically reasonable since the square of the gradient of the principal function is bounded. By contracting the characteristic differential one-form with the vortex vector, the Lagrangian is obtained.

Troy L. Story
Morehouse College

Date submitted: 09 Aug 2006

Electronic form version 1.4