1116-35-1665 **Nathaniel Trask**, **Martin Maxey**, **Kyungjoo Kim**, **Mauro Perego**, **Michael L Parks*** (mlparks@sandia.gov), **Kai Yang**, **Jinchao Xu**, **Wenxiao Pan** and **Alex Tartakovsky**. *A Massively Parallel Scalable Implicit SPH Solver.*

The most commonly used Smoothed Particle Hydrodynamics (SPH) implementation for solving the compressible Navier-Stokes (NS) equations is the Weakly Compressible SPH (WCSPH) method. This conventional approach suffers from convergence issues resulting from the spatial discretization – running WCSPH at larger scales to refine the discretization does not improve the quality of the solution. Further, small timesteps may be required, as dictated by the CFL condition, requiting substantial computational expense. To address these issues, we utilize local correction tensors in the context of an implicit SPH method, providing second order convergence while allowing for much larger timesteps. We provide a scalable massively parallel implementation of the resulting Implicit Smoothed Particle Hydrodynamics (ISPH) method in the LAMMPS molecular dynamics code, utilizing Krylov solvers and algebraic multigrid preconditioners from the Trilinos library, and demonstrate the method on several problems of interest. (Received September 21, 2015)