1014-65-771 **Sarah A. Williams*** (sawilliams@ucdavis.edu), UC Davis, Department of Mathematics, One Shields Ave, Davis, CA 95616. *A Fast Multipole Method-based Poisson Solver for Use in Fluid Simulation.* Preliminary report.

This poster demonstrates the performance of a Poisson solver based on the Fast Multipole Method (FMM-PS) (see Greengard and Rokhlin, 1987; Ethridge and Greengard, 2001). While Krylov subspace and Multigrid methods have been widely used in the fluid dynamics setting, this research suggests that the FMM-PS should be considered an important alternative black box solver. Like Multigrid, it has O(N) complexity, and a fast implementation has been developed and adapted to work in the context of a projection method for fluid simulation. Here we show that the FMM-PS is competitive with Multigrid in terms of accuracy and robustness.

The accuracy of the Multigrid solution is limited by discretization error, which is a constraint of any method based on a standard finite difference approximation to the Poisson problem. Since the FMM-PS does not rely on a finite-difference analog of the Poisson problem, any desired level of accuracy (up to machine precision) can be achieved. A smooth test problem demonstrates this principle. A test problem with a non-smooth right hand side demonstrates the competitive robustness of the FMM-PS. (Received September 23, 2005)