1105-65-19 **Alexander Linke**, **Michael Neilan**, **Leo Rebholz*** (rebholz@clemson.edu) and **Nick Wilson**. *A connection between coupled and penalty projection timestepping schemes with FE spatial discretization for the Navier-Stokes equations.*

We prove that in finite element settings where the divergence-free subspace of the velocity space has optimal approximation properties, the solution of Chorin/Temam projection methods for Navier-Stokes equations equipped with grad-div stabilization with parameter γ, converge to the associated coupled method solution with rate γ^{-1} as $\gamma \to \infty$. We prove this first for backward Euler schemes, and then extend the results to BDF2 schemes, and finally to schemes with outflow boundary conditions. Several numerical experiments are given which verify the convergence rate, and show how using projection methods in this setting with large grad-div stabilization parameters can dramatically improve accuracy. (Received July 02, 2014)