1108-65-440 **Gideon Simpson*** (`simpson@math.drexel.edu`), Korman Center - Room 206, 33rd and Market Streets, Department of Mathematics, Philadelphia, PA 19104. *Petviashvilli's method for the Dirichlet problem.*

Nonlinear bound states, including solitons, play an important role in the dynamics of many nonlinear partial differential equations. To explore their dynamics and stability in simulation, it is of value to have an algorithm which can efficiently compute such solutions. These nonlinear bound states typically solve semilinear elliptic equations of the form $\phi - \Delta\phi = |\phi|^{p-1}\phi$ on $\mathbb{R}^d$, vanishing at infinity. This introduces the challenge that since zero is a solution, there is little, a priori, preventing a nonlinear solver from converging to the zero solution instead of something more interesting. This motivated the development of robust algorithms, such as Petviashvilli's method, which can accommodate very poor starting guesses, yet still converge to nontrivial solutions. In this talk, I will present new results towards an explanation of the apparent global convergence of these algorithms, when the problem is considered on a bounded domain with Dirichlet boundary conditions. Numerical examples in 1D and 2D will be given and open problems will be highlighted. (Received January 19, 2015)