1019-35-172   **John M Neuberger*** (`John.Neuberger@NAU.Edu`), Department of Mathematics and Statistics, Box 5717, NAU, Flagstaff, AZ 86011, and **Nandor Sieben** and **James W Swift**. *Symmetry and Automated Branch Following for Nonlinear Elliptic PDE and PdE on Graphs*. Preliminary report.

This talk concerns the Generalization of PDE to PdE (Partial Difference Equations) on graphs. We apply symmetry analysis and investigate bifurcation phenomena for nonlinear elliptic equations of the form $-Lu + \lambda u + f(u) = 0$, where L is the well known graph Laplacian operator and u is an unknown function taking values at the vertices of some graph G. Our simulations use the gradient Newton-Galerkin algorithm (GNGA) of Neuberger and Swift. Currently, we are automating: the isotopic decomposition of the underlying vector space for each graph based on symmetry and the corresponding eigenfunctions, the graph layout, and the search directions for Newton's method at bifurcation points with high-dimensional critical eigenspaces. We will present visual representations of solutions to the nonlinear problem for various graphs. (Received August 14, 2006)