Pattern formation on graphs

Graphs are commonplace mathematical models in many disciplines, including
neuroscience, computer networks and traffic systems. Pattern formation, on
the other hand has traditionally been studied in the context of continuum models
(partial differential equations), which have applications as wide ranging as chemical
reactions, fluid turbulence and biological morphogenesis.

Dynamical processes associated with networks can also form patterns, analogous to those
found in continuum models. The goals of this project are: (1) establish some background
on the theory of pattern formation, (2) replicate simulations of pattern formation on graphs,
using MATLAB and other numerical tools, (3) seek out new phenomenon, such as localized
waves and complex structures.

Reference: Asllani et al, The theory of pattern formation on directed networks,
Nature Communications 2014.

Prerequisites: ODEs, Linear Algebra, experience with MATLAB. Ideally one or more of:
Graph Theory (math 443), Dynamical Systems (math454), PDEs (math456), Numerical Methods
(math475)