COLLOQUIUM
UNIVERSITY OF PITTSBURGH

FRIDAY, SEPTEMBER 4, 2015

704 THACKERAY HALL

3:30 P.M.

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GRAPHS, DYNAMICS & PERSISTENT ACTIVITY

ABSTRACT: Persistent or re-entrant activity (PA) in systems of coupled neurons, cardiac myocytes, etc is a common feature that can be desired or pathological, depending on the context. This activity arises in networks of excitable elements when there are re-entrant paths. Simultaneous activation (synchronization) of the units leads to silencing of the persistent activity. Thus, PA and quiescence represent two stable states of the network (bistability). A natural question is how does the topology of the connectivity between the elements in the network affect the existence of re-entrant or persistent activity. In this talk, I will first relate re-entrant activity in excitable units, to non-synchronous locked patterns in networks of coupled oscillators. With this convenient homotopy, I will turn my attention to systems of equations of the form:

$$\xi' = \sum_{j}^{g_{ij}} \sin(xj - \xi + \alpha)$$

where g_{ij} is the connection graph of 0's and 1's. I will focus almost entirely on regular undirected graphs where each node has exactly k edges. With a brief introduction to $k = 2$, I will present some recent results on $k = 3$ and $k > 3$ where the graphs either have some symmetry or are random. I will construct stable nonsynchronous solutions (re-entrant) and also explore the dynamics on random regular graphs. Finally, I will also briefly describe some approaches that use algebraic geometry to exhaustively search for patterns. This work was done in collaboration with Lawrence Udeigwe and a small army of undergraduate students.

Refreshments served at 3:00 p.m.
in the Math Dept. COMMON ROOM, Thackeray 705