

California State University, Fullerton

DEPARTMENT of MATHEMATICS

Robert Rovetti

Loyola Marymount University
Department of Mathematics

“The Game of Life (and Sudden Death): Predicting Cardiac Instabilities at Multiple Scales with Nonlinear Stochastic Models”

Cardiac cells have a surprisingly complex architecture, and dynamic instabilities within them may lead to ventricular fibrillation, the leading cause of sudden cardiac death. The principle contractile signal, calcium release, must rise and fall in a controlled fashion, yet is a result of the random action of thousands of subcellular "Calcium Release Units" (CRUs). How does the cardiac cell produce an orderly signal from a seemingly random process, and what causes this system to break down?

We will first examine the dynamics of a single CRU represented as a Birth-Death (Markov) Process with multiple "fixed points". At a higher scale, we consider a network of such CRUs, encoding their properties into a Cellular Automata scheme. We analyze the average (ensemble) behavior of the system with an iterated map function and find sufficient conditions under which calcium release undergoes a period-2 bifurcation to instability.

Friday, Nov. 6

**1-2 pm
MH 468**