HARVARD MEDICAL SCHOOL | BLAVATNIK INSTITUTE SYSTEMS BIOLOGY

DEPARTMENT SEMINAR

HOST: JEREMY GUNAWARDENA

PIETER VEERMAN

PROFESSOR OF MATHEMATICS
PORTLAND STATE UNIVERSITY

TALK TITLE:

DYNAMICS OF CHEMICAL REACTION NETWORKS

ABSTRACT:

The study of the dynamics of chemical reactions, and in particular phenomena such as oscillating reactions, has led to the recognition that many dynamical properties of a chemical reaction can be predicted from graph theoretical properties of a certain directed graph, called a Chemical Reaction Network (CRN). In this graph, the edges represent the reactions, and the vertices the reacting combinations of chemical substances.

In contrast with the classical treatment, in this work, we heavily rely on a recently developed theory of directed graph Laplacians to simplify the traditional treatment. We show that much of the dynamics of these polynomial systems of differential equations can be understood by analyzing the directed graph Laplacian associated with the system.

Our new theory allows a more concise mathematical treatment and leads to considerably stronger results. In particular, (i) we show that our Laplacian deficiency zero theorem is markedly stronger than the traditional one and (ii) we derive simple equations for the locus of the equilibria in all (Laplacian) deficiency zero cases.

TUESDAY, FEBRUARY 28, 2023
WARREN ALPERT 563
3:00 PM