香港浸會大學
HONG KONG BAPTIST UNIVERSITY

DEPARTMENT OF PHYSICS
物理系

物理系
DEPARTMENT OF PHYSICS

Understanding endogenous behaviour during epidemics using Nash Neural Networks

Prof Matthew S. Turner

Department of Physics, University of Warwick

Register Now

Date: Mar 30, 2023 (Thursday)
Time: 3 – 4 pm Talk by Prof Turner
4 – 6 pm Sharing & Discussion
Venue: OEE603, HSHC Campus

ABSTRACT

We analyse endogenous behaviour and policy in the presence of a simple (SIR) epidemic in which the population consists of identical, rational individuals without added uncertainty. Individuals and government are bestowed with an objective function that, e.g. balances the cost of social distancing with the benefit of a reduced chance of infection. Governments are able to impose taxes or offer incentives to change individual behaviour so as to target the maximum of their own objective function. This represents a novel form of control theory with two hierarchies of control - for individuals and government. The objective function, or utility, then completely determines the behaviour. In the final part of my talk I will consider the inverse problem, in which behaviour is observed and a hidden objective function is to be inferred. We develop a new physics-inspired machine learning methodology that we call a "Nash Neural Network" with many possible applications beyond epidemiology.

BIOGRAPHY

PhD in theoretical soft condensed matter physics from Cambridge University, supervised by Mike Cates (now Lucasian professor) working on the dynamics of polymers that can exchange mass; president of Trinity College BA Society. Then I moved to a postdoc with Jean-Francois Joanny in Strasbourg France where I developed models of polymeric liquid crystals. In 1991 I was elected a Fellow of Trinity College Cambridge. I then held a Royal Society University Research Fellowship in Cambridge which I took to the University of California at Santa Barbara to work in the KITP on theory of membranes. I was then appointed to the faculty at Warwick University before taking up the W M Keck fellowship in the Centre for Studies in Physics and Biology at Rockefeller University from 1998-2001. I learned much about Biology at Rockefeller and worked on protein-DNA interactions. In recent years I have enjoyed a Joliot-Curie visiting fellowship at ESPCI, Paris and held the Mayant-Rothschild visiting professorship at Institut Curie, Paris. In 2010 I won an EPSRC "Leadership Fellowship". I've spent much of the last 3 years in Japan on sabbaticals funded by fellowships from the JSPS and the Leverhulme trust. Recently, I've been having a lot of fun working on some completely new problems in both collective motion and the interface between mathematical epidemiology and economics.