University of Manitoba

Pacific Institute for the Mathematical Sciences

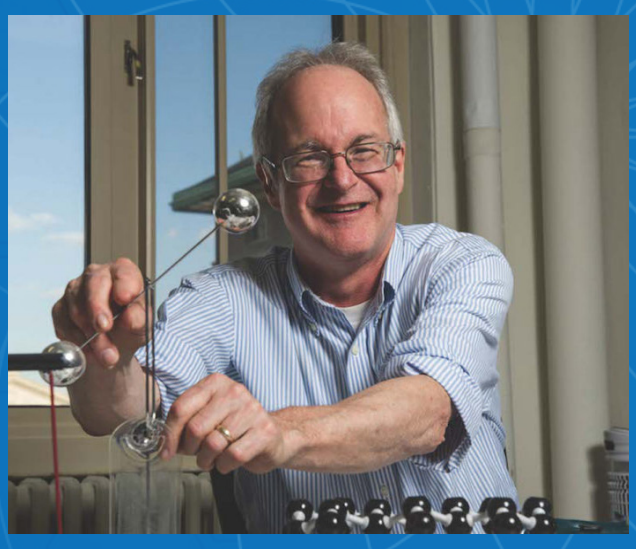
PIMS - UMANITOBA LECTURE

BARD ERMENTROUT

Wednesday, October 9, 2019
4:00 pm

Robert B. Schultz Lecture Theatre
University of Manitoba

IF SPACE TURNED OUT TO BE TIME: RESONANCES AND PATTERNS IN THE VISUAL CORTEX



Bard Ermentrout

Distinguished University Professor of Computational Biology and Professor of Mathematics
University of Pittsburgh

Biography

Bard Ermentrout received his PhD in Theoretical Biology at the University of Chicago and was a postdoctoral fellow at the NIH from 1979-1982. He has been at the University of Pittsburgh since then. He is the author of over 200 papers and two books as well as the simulation package, XPPAUT. He is a Sloan Fellow and a SIAM Fellow and received the Mathematical Neuroscience Prize in 2015.

Abstract

When subjects are exposed to full field flicker in certain frequencies, they perceive a variety of complex geometric patterns that are often called flicker hallucinations. On the other had, when looking at high contrast geometric patterns like op art, shimmering and flickering is observed. In some people, flicker or such op art can induce seizures. In this talk, I describe a simple network model of excitatory and inhibitory neurons that comprise the visual area of the brain. I show that these phenomena are reproduced and then give an explanation based on symmetry breaking bifurcations and Floquet theory. Symmetric bifurcation theory also shows why one expects a different class of patterns at high frequencies from those at low frequencies.

On the other hand, the visual system is also very sensitive to specific spatial frequencies and this sensitivity can be pathological in the case of so-called pattern-senstive epilepsy. It has been shown that certain types of “op art”can cause visual discomfort. We show that the network that we used in flicker is also sensitive to spatially periodic inputs and suggest that a Hopf bifurcation instability is responsible for the discomfort and seizures.

MORE DETAILS: HTTPS://WWW.PIMS.MATH.CA/SCIENTIFIC-EVENT/191009-PUDLBE