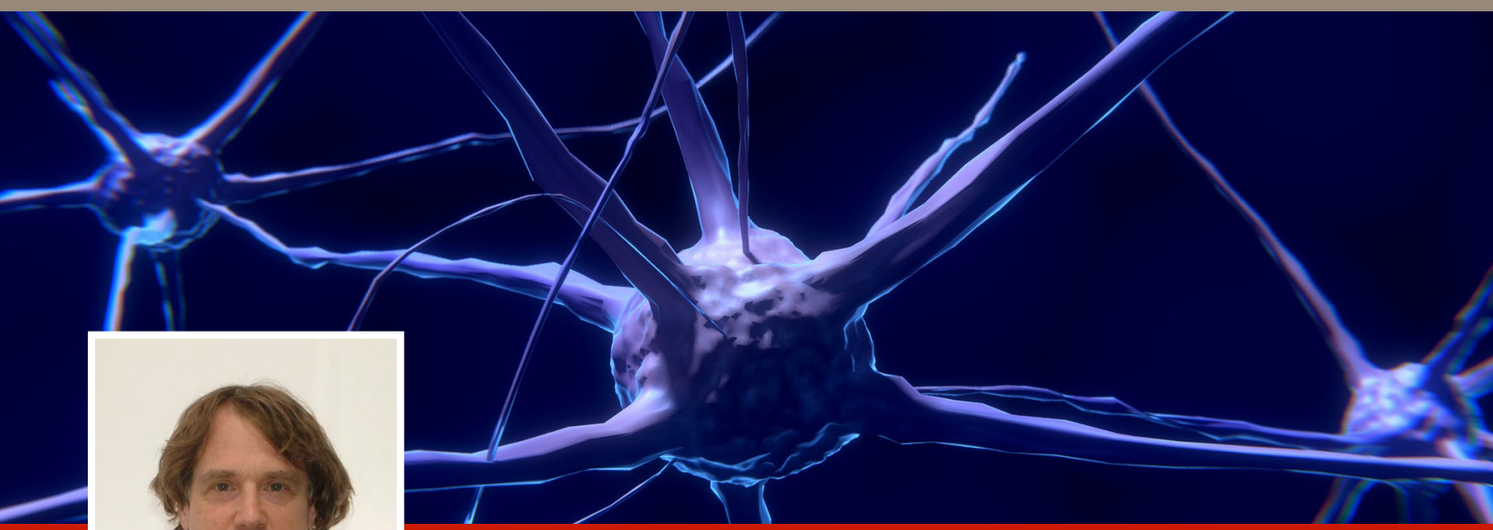
PHYSICS AND ASTRONOMY COLLOQUIUM SPEAKER SERIES



The physical limits of sensory detection, focus and control

Dr. André Longtin
Professor of Physics
University of Ottawa

André Longtin is Professor and Chair of the Physics Department at the University of Ottawa. He holds the University Research Chair in Neurophysics, and directs the Centre for Neural Dynamics. He is also cross-appointed to the departments of Cellular and Molecular Medicine and Mathematics and Statistics. His interest lies in deterministic and stochastic principles of brain function. He received his B.Sc. and M.Sc. in Physics from the Université de Montréal in 1983 and 1985, and his Ph.D. in Physics from McGill in 1989. He was a postdoc in the Complex Systems Group of the Theoretical Division at Los Alamos National Laboratory for two years before joining the University of Ottawa in 1992. He is a fellow of the American Physical Society, and a senior Humboldt Fellow. He was awarded the NSERC Brockhouse Canada Award for Interdisciplinary Research in 2017 with his long-time collaborator, neurobiologist Len Maler, in recognition of their joint efforts at cracking the neural code.

Theoretical studies of brain computing have led to advances in biophysics as well as statistical and nonlinear physics. Recent advances are highlighted here in the context of sensory systems. These systems provide a particularly good window onto questions of neural dynamics, control, information processing and memory, because they have a well-characterized physical input. I will first present recent work on a novel information processing strategy at the limit of sensory detection. Then I will describe the strategy behind sensory “focussing”, a novel principle used to bring an object to a maximally “informative” distance. I will describe a fascinating memory mechanism by which the spatial relationship between objects relies on a space-to-time conversion. Finally I will discuss a stochastic optimal control problem for neural spiking, and its possible relevance to brain-computer interfaces and brain control. In sum, physical theory is actively being developed to explain brain data and make novel predictions about the underlying computational strategies.

Friday, March 16
Science B 148
4:00 pm

Refreshments provided
Everyone is welcome!

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