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Physics research talks 2023-24

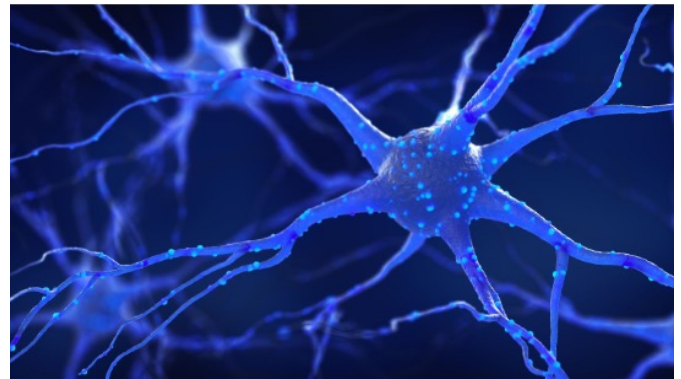
Finlay Potter

Artificial Neurons with Quantum Memristors

Wed 28 Feb 2024, 16.00 DAV1.064

Neuromorphic computing is a proposed alternative style of computing to traditional von Neumann computing, where transistors are replaced with brain-inspired artificial neuron circuits that can simultaneously process and store data.

One proposal for an artificial neuron circuit uses *memristors*, which are nonlinear circuit elements where resistance depends on the history of charge passing over it, to generate self-oscillations as a form of spiking. These oscillations can then be used to encode information.



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Taking inspiration from a specific type of memristor, called a *diffusive memristor*, we will consider a model for a two-level quantum device with dephasing, due to environmental influences, in the context of an artificial neuron circuit. In this talk, I will explain how my research uses theory and tools from the study of dynamical systems to study this model. I will then demonstrate how they can be applied to this model to produce hysteresis, which is a key component of memory, and interpret this as corresponding to a fully

dephased state. We will then use this to show that the system also produces self-oscillations (which could be used for encoding information in neuromorphic systems) which are quantum in origin but still require environmental effects.

All welcome! Some knowledge of quantum mechanics would be useful.

<https://www.lboro.ac.uk/departments/physics/events/seminars/research-talks/>

Next talk: Alexander Minns, How does the brain process information? Wed 20 Mar, 16:00, DAV1.102

If you would like to give a talk in this series, please contact John Samson

