Automating the Final Examination of Hirokjyoti Kalita for the degree of Master of Science

Title: ARTIFICIAL NEURON USING MOS2/GRAPHENE THRESHOLD SWITCHING MEMRISTOR

With the ever-increasing demand for low power electronics, neuromorphic computing has garnered huge interest in recent times. Implementing neuromorphic computing in hardware will be a severe boost for applications involving complex processes such as pattern recognition. Artificial neurons form a critical part in neuromorphic circuits, and have been realized with complex complementary metal-oxide-semiconductor (CMOS) circuitry in the past. Recently, insulator-to-metal-transition (IMT) materials have been used to realize artificial neurons. Although memristors have been implemented to realize synaptic behavior, not much work has been reported regarding the neuronal response achieved with these devices. In this work, we use the volatile threshold switching behavior of a vertical MoS2/graphene van der Waals heterojunction system to produce the integrate-and-fire response of a neuron. We use large area chemical vapor deposited (CVD) graphene and MoS2, enabling large scale realization of these devices. These devices can emulate the most vital properties of a neuron, including the all or nothing spiking, the threshold driven spiking of the action potential, the post-firing refractory period of a neuron and strength modulated frequency response. These results show that the developed artificial neuron can play a crucial role in neuromorphic computing.

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Approved for distribution by Tania Roy, Committee Chair, on June 4, 2018.

The public is welcome to attend.