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Abstract Submitted
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A 2D Material based Gate Tunable Memristive Device for Emulating Modulatory Input-dependent Hetero-synaptic Plasticity.[1] XIAODONG YAN, HE TIAN, Univ of Southern California, YUJUN XIE, Yale University, ANDREW KOSTELEC, NG Next, Northrop Grumman, HUAN ZHAO, Univ of Southern California, JUDY J. CHA, Yale University, JESSE TICE, NG Next, Northrop Grumman, HAN WANG, Univ of Southern California — Modulatory input-dependent plasticity is a well-known type of hetero-synaptic response where the release of neuromodulators can alter the efficacy of neurotransmission in a nearby chemical synapse. Solid-state devices that can mimic such phenomenon are desirable for enhancing the functionality and reconfigurability of neuromorphic electronics. In this work, we demonstrated a tunable artificial synaptic device concept based on the properties of graphene and tin oxide that can mimic the modulatory input-dependent plasticity. By using graphene as the contact electrode, a third electrode terminal can be used to modulate the conductive filament formation in the vertical tin oxide based resistive memory device. The resulting synaptic characteristics of this device, in terms of the profile of synaptic weight change and the spike-timing-dependent-plasticity, is tunable with the bias at the modulating terminal. Furthermore, the synaptic response can be reconfigured between excitatory and inhibitory modes by this modulating bias. The operation mechanism of the device is studied with combined experimental and theoretical analysis. The device is attractive for application in neuromorphic electronics.

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