Nanoscale size limitations and quantum mechanical phenomena enabled the design of fullerenes, low-dimensional materials, and quantum dots, to name a few, for disruptive technological innovations for the past few decades. Utilizing similar phenomena, the atomic switch derived from crosslinked nanowires introduced an alternative design architecture for Beyond-Moore computing. An atomic switch is a 2-terminal metal-insulator-metal device where the insulating region is < 10 nm which undergo transmission tunneling under a voltage bias. Observations of a transition from α-monoclinic to βargentite phase abruptly increases the tunneling current to an “ON” state. In addition, thermodynamically driven redox reactions modulate the tunneling current due to changes in the surface energy and morphic topology. The simplicity of our processing method and enables us to utilize these devices as a Turing B-type unorganized machine for unconventional computing. Here we show the holistic design, characterization, and implementation of a massively parallel neuromorphic network based on metal chalcogenide atomic switch systems.

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