“Neuromorphic Nanowire Networks as a Physical Substrate for In-Materio Reservoir Computing”

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ABSTRACT: Self-organized nanowire arrays of memristive materials, known as atomic switch networks, are the collection of billions of individual memristive elements randomly intertwined as an interconnected network of electrically active junctions. The resulting morphology of the network has a number of attractive neuromorphic properties and emergent phenomena which yield an intrinsic capacity to perform complex computational tasks on a physical substrate. Under an external stimulus these networks exhibit a dynamic, non-equilibrium modulation of conductance across the entire network. The resultant non-linear dynamics are capable of being utilized as both logic and memory components operating in parallel through a technique called in-materio computing. This form of computing enables a physical substrate to be utilized as a dynamic reservoir capable of transforming a simple external stimulus into higher dimensional non-linear outputs. The output layer is then mapped onto a desired computational task through a technique called reservoir computing (RC). Silver selenide and silver iodide based nanowire networks were characterized and implicated as efficient memristive materials for RC applications. Both materials were successfully employed within an RC framework for waveform regression, spoken digit recognition and handwritten digit classification tasks.

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& via Zoom

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