Dynamical Pathway Tuning in Neuromorphic Nanowire Networks

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Neuromorphic networks are complex systems formed by nanomaterials whose connectivity is regulated by resistive switching behaviour. Neuromorphic networks formed by silver nanowires were created. Sleep-cycle inspired memory retention [1], critical dynamics [2] or associative pattern recognition [3] are amongst the features arising when networks are subjected to different electrical signals. However, critical aspects such as pathway controllability and stability are yet to be explored.

In this presentation, I will introduce one of our latest results using networks formed by Ag nanowires decorated with TiO2 nanoparticles [4]. Pathway formation is investigated achieving for the first time direct pathway visualization by means of the lock-in thermography technique. Using this technique, we showed how networks can preserve information from previously used pathways through increased local junction connectivity. This effect directly reshapes subsequent formation of pathways whenever the spatial location of the electrodes is dynamically changed. Combining these results with conventional current–voltage spectroscopy, a unique interaction between short-term and long-term memory is detected. Results show that controlled spatiotemporal signals that are dynamically fed to the network can led to states of potentiation and inhibition of network conductance.

REFERENCES

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FIGURES