Self-assembled neuromorphic networks: modeling of functional and topological connectivity

Neuromorphic computing aims to revolutionize the current computer paradigm by addressing the memory delocalization inherent in the standard von Neumann architecture.

Self-assembled memristive networks, characterized by collective behavior and non-linear responses, are gaining traction in the neuromorphic community; dynamical and topological modeling is central to developing these neuromorphic substrates.

We addressed the *functional connectivity* between electrodes in mixed memristor-resistor neuromorphic networks. The fraction of impurities controls the functional connectivity between electrodes, producing selective or non-selective conduction traces.

To address *topology*, we developed a compact and tractable model for creating synthetic instances of domain walls (DWs) networks in $BiFeO_3$ thin films. Stochastic geometry parametric modeling is optimized through multiscale spectral entropy. The method yields binary images of DWs networks and graph-based network descriptions, offering a flexible framework applicable to other microstructures.