

Evento organizzato nell'ambito di Engineering
Physics Colloquia



Ca' Foscari
University
of Venice
Department of
Molecular Sciences
and Nanosystems

Complexity in Organic Mixed Ionic Electronic Conductors and its Application in Neuromorphic Computing

19th September 2024, h 11.00 am
Conference Room Orio Zanetto, Alfa Building

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Complexity is a decisive property enabling systems to work at the edge of chaos, which is necessary for resource-efficient computing and the design of intelligent machines. The complex behavior of a system originates from the nonlinear properties of all its components, resulting in a plethora of different signatures such as multi-state stability, stochastic oscillations, etc. These nonlinear properties and their couplings need to be understood and modeled to develop intelligent & energy-efficient computers.

Organic mixed ionic-electronic conductors (OMIECs) based on conjugated polymers open up a fascinating field of research where the ionic-electronic coupling, in combination with correlation effects at high charge carrier densities, enables

the implementation of various paradigms of neuromorphic computing. In this contribution, I will discuss the various signatures of nonlinearity and complexity that have been observed in OMIECs in recent years and review the current understanding of these effects. Furthermore, I will discuss how phenomena such as hysteresis and bistability can be employed to design fundamental elements of asynchronous computing, such as spiking neurons or C-elements, providing the foundation for the efficient implementation of approaches of stochastic computing in hardware. Finally, I will present a technology platform that allows us to integrate such devices in all-printed, complementary circuits operating above 1kHz.

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