

Organic neuromorphic electronics

Paschalis Gkoupidenis

Associate Professor

Department of Electrical and Computer Engineering

Department of Physics

North Carolina State University

E-mail: pgkoupi@ncsu.edu

web: <https://ece.ncsu.edu/people/pgkoupi/>

group: NCSU, Max Planck

Abstract

Organic neuromorphic electronics harnesses ionic and electrochemical processes to emulate core features of synaptic adaptation and neural computation in a bio-realistic and highly efficient manner. In this talk, we will explore how organic and iontronic materials enable the design of neuromorphic devices and circuits that can sense, process, and respond in real time, forming the foundation for both intelligent systems and efficient neuromorphic biointerfaces.

References

1. P. Gkoupidenis, Y. Zhang, H. Kleemann, H. Ling, F. Santoro, S. Fabiano, A. Salleo, Y. van de Burgt, *Organic mixed conductors for bioinspired electronics*, Nat. Rev. Mater. 9, 134 (2024).
2. T. Sarkar, K. Lieberth, A. Pavlou, T. Frank, V. Mailaender, I. McCulloch, P. W. M. Blom, F. Torricelli, P. Gkoupidenis, *An organic artificial spiking neuron for in situ neuromorphic sensing and biointerfacing*, Nat. Electron. 5, 774 (2022).
3. I. Krauhausen, D. Koutsouras, A. Mellianas, S. T. Keene, H. Ledanseeur, K. Lieberth, A. Giovannitti, F. Torricelli, I. McCulloch, P. W. M. Blom, A. Salleo, Y. van de Burgt, P. Gkoupidenis, *Organic neuromorphic electronics for sensorimotor integration and learning in robotics*, Sci. Adv. 7, 50 (2021).
4. Y. van de Burgt, P. Gkoupidenis, *Organic materials and devices for brain-inspired computing: From artificial implementation to biophysical realism*, MRS Bullet. 45, 8 (2020).
5. P. Gkoupidenis, N. Schaefer, B. Garlan, G. G. Malliaras, *Neuromorphic functions in PEDOT:PSS organic electrochemical transistors*, Adv. Mater. 27, 7176 (2015).