Laboratoire Matériaux et Phénomènes Quantiques

“Physics for neuromorphic computing”

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Participer à la réunion Zoom

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résumé :

In this talk, I want to show that the joint development of new materials, nanodevices and algorithms is essential for the development of smart and environmentally friendly chips, which inherently learn from their physics (*1*).

The goal of neuromorphic computing is to take inspiration from the architecture of the brain to build a low-power circuit for artificial intelligence. I will first give a brief overview of the state of the art of neuromorphic computing, highlighting the opportunities offered by emerging nanodevices in this field, and the related challenges. I will then show how physics can be exploited at the algorithm and device level to solve these challenges and unlock learning on a chip. I will illustrate the need for this material-algorithm co-development through examples of our work on an algorithm called Equilibrium Propagation that minimizes both error and energy of a dynamic system (*2*), and through the implementation of spintronic neural networks that communicate through radio-frequency waves (*3*, *4*).

1. D. Marković, A. Mizrahi, D. Querlioz, J. Grollier, *Nature Reviews Physics*, 1–12 (2020).
2. M. Ernoult, J. Grollier, D. Querlioz, Y. Bengio, B. Scellier, in *Advances in Neural Information Processing* Systems 32, pp. 7081–7091.
3. J. Torrejon et al., Nature. 547, 428–431 (2017).
4. M. Romera et al., Nature. 563, 230 (2018).

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