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Evolutionary complexity and the imitation game of Nature

Natural evolution has resulted in a multitude of multicellular organisms, which routinely use optimized nanostructures to perform complex operations. Although the working principle of these systems is still unclear, their common denominator is the presence of many interacting and fully heterogeneous units.

Evolutionary complexity aims at understanding the fundamental principles that govern such systems, exploiting their unique properties to create novel

nanostructures leading to diverse technologies. In this presentation, I summarize recent research in the field, discussing both fundamental and applied aspects. These encompass the exploitation of irreversible chaotic dynamics for energy harvesting, the control of rare catastrophic events at nanoscale, coherent light generation from black-bodies, biomimetic nanomaterials with unique properties, record performing photocatalysis membranes generated by warped spaces, early stage cancer detection, and optical neural networks.

