Bollettino Settimanale

Lunedì 4 marzo 2024	Martedì 5 marzo 2024	Mercoledì 6 marzo 2024	Giovedì 7 marzo 2024	Venerdì 8 marzo 2024
AULA CONVERSI ore 16.00 **SEMINARIO** **Memory, Light, Spin Glasses, and Deep Classification.** *Marco Leonetti (CNR Sede di Roma)* Seminario CNR-NANOTEC Memory serves as the foundation for computing in both artificial and biological systems. The pioneering Hopfield model represents the initial physical-mathematical framework for memory, linking memory components to the synaptic matrix—a mathematical structure housing neural synaptic weights. Recently, a connection has been established between the Hopfield memory model and the physics governing the intensity of light transmitted through a multitude of disorganized light rays [1-2]. In fact, the transmission of light through a disordered, strongly scattering medium can be elucidated using the transmission matrix—a two-dimensional array delineating the attenuation and dephasing of each light mode/ray. This mapping between the optical transmission matrix and the memory synaptic matrix finds various applications. Primarily, we harnessed this connection to develop a photonic analog optical computer capable of dynamically calculating spin glass system dynamics, presenting an advantage over digital counterparts. Additionally, we utilized the intrinsic random memory patterns stored into a scattering medium to create an optical storage system [3]. These random memories can be leveraged to generate higher-hierarchy archetype memories in an emergent manner. In contrast to random memories, archetype memories can be purposefully designed by users to store meaningful information. Furthermore, we demonstrated the merging of multiple archetype memories to realize a fully optical programmable classifier, providing enhanced efficiency compared to previous architectures. [1] ML et al: Photonic Stochastic Emergent Storage for deep classification by scattering-intrinsic patterns, Nature Communications 15, 505 (2024). [2] ML et al: Reference-less wavefront shaping in a Hopfield-like rough intensity landscape, Opt. Express 31, 28987-28998 (2023) [3] ML et al: Optical computation of a spin glass dynamics with tunable complexity; PNAS May 25, 2021 118 (21) e2015207118.	**AULA CONVERSI ore 16.00** **SEMINARIO DI ASTROFISICA** **Astrochemistry: a powerful tool to understand the origin of complexity in the Universe.** *Stefano Bovino (Dipartimento di Chimica – Univ. Sapienza)* Astrochemistry is a blend of different disciplines, from chemistry to astronomy, including computational sciences and biology. One of the fundamental questions in astrochemistry is related to the understanding of intricate physical processes like star- and planet-formation, and how these are connected to the emergence of chemical complexity. In this talk I will introduce the astrochemistry field, showing its different applications. I will present some recent exciting magneto-hydrodynamical simulations and introduce how the chemistry can help disentangling among the main processes which lead to the formation of stars. It will be a journey from the simple chemistry of diffuse gas to the complexity of the small and dense regions of the interstellar medium, where complex chemical processes play a fundamental role to unveil our astrochemical origins.			