



# Workshop on **COMPLEX SYSTEMS**

6 giugno 2023, Aula 4

Organizzazione: prof. Angela De Sanctis

Attività dell'International Center for Nonlinear Dynamics and Complex Systems  
Dipartimento di Economia Aziendale

Ore 10: Prof. Mirko Degli Esposti (Università di Bologna)

## **Entropy, Irreversibility, DNA sequences... and Fake Faces**

Abstract: Entropy and irreversibility, two fundamental concepts underlying physical processes, and now also at the core of digital processes for simulation and evolution of artificial models. We will touch on some of these aspects, taking as our starting point the well-defined and well-explored mathematical context of infinite sequence spaces over finite alphabets. As we will see, universal estimators of typical signal entropy and cross entropy, based on the asymptotics of recurrences and waiting times, play an important role in information theory, and we will discuss some mathematical results.

We will discuss some applications to DNA sequences, particularly in understanding the so-called Second Chargaff Rule, a still unexplained family of empirical symmetries present in "most" genetic sequences. We will conclude with some suggestions to show how concepts proper to statistical mechanics and thermodynamics, such as entropy and irreversibility, have become fundamental even in the most recent synthetic image generation models.

Ore 11:30: Prof. Peter J. J. Veerman (Portland State University)

## **Social Balance**

Abstract: We outline the history of the mathematical study of the formation of factions in human groups and then give an idea of the mathematical analysis of a prominent model. A simulation will be included and by way of conclusion we outline some current research.