

# Statistical Mechanics of Random Hyperbolic Graphs

M. Ángeles Serrano<sup>1</sup>

<sup>1</sup>University of Barcelona, Spain

The family of network models in hyperbolic space represents one of the most advanced frameworks for describing the structure of many real-world complex systems. These networks are typically sparse, small-world, heterogeneous, highly clustered, and scale-invariant under network renormalization. These geometric models also show intriguing behaviour, such as an anomalous, temperature-dependent transition between a geometric and a non-geometric regime.

In this talk, I will describe the model and explain how it can be derived within a statistical mechanics framework by maximizing entropy subject to constraints imposed by observations, with links effectively behaving as fermionic particles. This approach yields a minimally biased baseline for predicting network properties and provides a principled framework for analyzing network structure, offering new perspectives and analytical tools for both theoretical work and empirical studies.