

## **Brain-like Dynamics of Light**

What makes the brain so energy efficient at information processing? In the first part of my talk, I will address this question from a nonlinear dynamics perspective and discuss three features of the brain that stand out to me in this context. First, the brain uses excitable units (*aka* neurons) as building blocks of networks processing information. Second, the brain operates in a noisy environment. Third, the brain can self-organize to a state that is convenient for information processing; this includes the emergence of collective oscillations and of scale-free structures in space and time. In the second part of my talk, I will discuss the realization of these three features in nonlinear optical resonators, and the advantages that optics offers in this endeavor. I will show how optical resonators can display excitability, how they can leverage noise (fluctuations in the amplitude and phase of light) to achieve energy-efficient functionality, and how they can self-organize to the edge of a first order phase transition where scale-free structures and collective oscillations between 'up' and 'down' states can emerge. To conclude, I will discuss some characteristics of optical systems that make them ideal for neuromorphic computation, and the challenges that they still face.