



Seminar/Talk

The bursting brain and the integrated nature of physiologic states: From neuronal avalanches to network physiology and beyond

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Bursting dynamics is a recurrent feature in natural phenomena, and a fundamental property of physiological systems across the human body. In the brain, the near synchronous firing of many neurons gives rise to collective behaviors such as oscillations and neuronal avalanches, key features of the resting activity of cortical networks. In the first part of this talk, I will discuss recent work on avalanche dynamics in cortex slice cultures and in mammalian brains (humans and rats) across the sleep-wake cycle, with a particular emphasis on the relationship between criticality and the temporal organization of neuronal avalanches. I will then switch the focus from the isolated brain to the integrated network of organs in the human body, where different complex physiological systems continuously interact to optimize and coordinate their function, and produce distinct physiologic states. Organ-to-organ interactions occur at multiple levels and spatiotemporal scales and are essential for an optimal global behaviour of the network. Despite the importance of these interactions for maintaining health, little is known about their nature and dynamics. Here I will demonstrate how physiologic network topology and systems connectivity can be associated to emerging behaviors representative of distinct states and functions. I will also show that universal, age-independent laws govern physiological networks at different levels of integration in the human body (brain-brain, brain-organ and organ-organ), and that transitions across physiological states are associated with specific changes in the network organization. These investigations represent a first step towards a holistic approach to human physiology that aims to associate distinct conditions to networks of interactions inferred from synchronous recordings of several organs across the human body, and predict their evolution in response to perturbations (e.g. organ failure, medical treatments).

Wednesday, August 8, 2018 01:00pm - 02:00pm

Meeting room 1st floor / Central Bldg. (I01.10G - Zentralgebäude)



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