Eugene Wigner Colloquium

event of SFB 910

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"Emergent excitability in populations of non-excitable units"

The Colloquium will take place online via Zoom. For information on how to access the event, please contact: henning.reinken@itp.tu-berlin.de

Thursday, 26.11.20 · 16:15h

Technische Universität Berlin · Institut für Theoretische Physik · Hardenbergstraße 36 · 10623 Berlin

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Emergent excitability in populations of non-excitable units

Excitability arises in many systems of either biological, chemical or physical nature. It refers to the ability of a system to produce a spike in response to an external stimulus and, together with self-sustained bursting oscillations, is one of the characteristic features of neural dynamics. Networks of excitable elements produce a macroscopic response that, in the presence of a suitable transport process, may propagate through the whole system. These patterns are among the most widespread examples of self-organization in active media and play an important role in neuronal information processing.

While the birth of a macroscopic dynamics related to the microscopic one is somehow expected, less clear are the mechanisms inducing collective behaviours, that substantially differ from those of the single elements.

In this talk, I will clarify how collective excitability and bursting oscillations can spontaneously emerge in adaptive networks of non-excitable units. The origin of these behaviors is related to the competition of fast synchronization/desynchronization phenomena triggered by a slow collective adaptation mechanism. These results open new perspectives in the context of mathematical neuroscience providing a clear demonstration of excitability as an emergent property.

M. Csizak, F. Marino, A.Torcini, S. Olmi, "Emergent excitability in populations of non-excitable units", *Phys. Rev. E*, Rapid Communication, in press, (2020).