ΣΕΜΙΝΑΡΙΟ ΚΕΝΤΡΟΥ ΚΒΑΝΤΙΚΗΣ ΠΟΛΥΠΛΟΚΟΤΗΤΑΣ & ΝΑΝΟΤΕΧΝΟΛΟΓΙΑΣ/ CCQCN SEMINAR

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11:00-12:00

3rd Floor Seminar Room

"Neural Network Dynamics, Information Processing & Sleep"

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Abstract

Our diverse cognitive abilities rely on the coordinated activity of 80 billion neurons, each of them interacting with thousands of other neurons. We investigate this collective neural dynamics and how it gives rise to the brain's information processing capabilities. A popular hypothesis is that the neural network assumes a critical state (2nd order phase transition), operating at the transition between stability and chaos. In models, this state maximizes processing capacity. Using in vitro experiments, we provided first evidence for the predicted maximization of processing capacity at criticality, and showed that around criticality, small changes in the dynamical state have large impact on information transfer and storage. However, despite the functional advantages of criticality, we found that in vivo spiking activity from rat, cat and monkey does not operate at criticality but in a slightly sub-critical state. Moreover, the precise distance to criticality changed from wakefulness to deep sleep. These results suggest that processing capacity is not bluntly maximized, but adapted physiologically to cognitive requirements.