Eugene Wigner Colloquium

joint event of GRK 1558 and SFB 910

SFB 910

Prof. Viktor Jirsa

Aix-Marseille Université

“Non-stationarity of the human resting state causes rich functional connectivity dynamics”

Functional connectivity opens a window on the interactions between different brain regions. Besides basic research, it is clinically relevant for applications in Alzheimer’s disease, schizophrenia, presurgical planning, epilepsy, and traumatic brain injury. Simulations of whole brain mean field computational models with realistic connectivity determined by tractography studies enable us to reproduce average functional connectivity in the resting state with remarkable accuracy. Previous computational studies, however, did not address the prominent non-stationarity in resting state functional connectivity, which may result in large intra- and inter-subject variability and thus preclude an accurate individual predictability. As we show here, this non-stationarity reveals a rich structure, characterized by rapid transitions switching between a few discrete functional connectivity states. We show that state-of-the-art computational models fail to reproduce these spontaneous state transitions and, thus, are not qualitatively superior to simplified linear stochastic models, which account for the effects of structure alone. We then demonstrate that a slight enhancement of the nonlinearity of the network nodes is sufficient to vastly broaden the repertoire of possible network behaviors, leading to modes of fluctuations which are strongly reminiscent of some of the most frequently observed Resting State Networks. Because of the noise-driven exploration of this dynamical as well as functional repertoire, the dynamics of functional connectivity changes now qualitatively and displays non-stationary switching as in empirical resting state recordings. It thus bears promise to serve as a better biomarker of resting state dynamics.

GRK1558 research training group

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