

СЪЮЗ НА МАТЕМАТИЦИТЕ В БЪЛГАРИЯ
ИНСТИТУТ ПО МАТЕМАТИКА И ИНФОРМАТИКА – БАН

НАЦИОНАЛЕН КОЛОКВИУМ
ПО МАТЕМАТИКА

*Поредната сбирка на Колоквиума ще се състои на 10 септември 2018 г. (понеделник)
от 16:15 часа в Заседателната зала на ИМИ – БАН,
София, ул. „Акад. Г. Бончев”, блок 8*

Доклад на тема:

*„The New Field of Network Physiology:
Mapping the Human Physiome“
ще изнесе проф. дфн Пламен Иванов
от Теоретичния отдел, Институт по физика на твърдото тяло
"Акад. Георги Наджаков", БАН
Keck Laboratory for Network Physiology, Physics Department, Boston University
Division of Sleep Medicine, Brigham and Women's Hospital, Harvard Medical School*

Поканени са всички интересувани се.

Ръководител на Колоквиума: акад. П. Попиванов

The human organism is an integrated network where complex physiological systems, each with its own regulatory mechanisms, continuously interact to optimize and coordinate their function. Organ-to-organ interactions occur at multiple levels and spatiotemporal scales to produce distinct physiologic states: wake and sleep; light and deep sleep; consciousness and unconsciousness. Disrupting organ communications can lead to dysfunction of individual systems or to collapse of the entire organism (coma, multiple organ failure). Yet, we know almost nothing about the nature of the interactions between diverse organ systems and their collective role in maintaining health. Through the prism of concepts and approaches originating in statistical and computational physics and applied mathematics, we will present basic characteristics of individual organ systems, distinct forms of pairwise coupling between systems, and a new framework to identify and quantify networks of interactions among diverse organ systems. We will demonstrate how physiologic network topology and systems connectivity lead to integrated global behaviors representative of physiologic states and functions. We will discuss implications for further theoretical developments and practical applications within the context of the emerging field of Network Physiology. The presented investigations are initial steps in building a first atlas of dynamic interactions among organ systems and the Human Physiome.

References:

1. Bashan A., et. al. "Network physiology reveals relations between network topology and physiological function." *Nature communications* (2012) 3: 702.
2. Bartsch R.P., et. al. "Network physiology: how organ systems dynamically interact." *PloS One* (2015) 10(11): e0142143.
3. Ivanov P.Ch., et. al. "Focus on the emerging new fields of network physiology and network medicine." *New Journal of Physics* (2016) 18(10): 100201.
4. Liu K.K.L., et. al. "Plasticity of brain wave network interactions and evolution across physiologic states." *Frontiers in Neural Circuits* (2015) 9: 62.
5. Liu K.K.L. et al. "Major component analysis of dynamic networks of physiologic organ interactions." *Journal of Physics: Conference Series*, 2015; 640, 012013
6. Lin A., et. al. "Delay-correlation landscape reveals characteristic time delays of brain rhythms and heart interactions." *Phil. Trans. R. Soc. A* (2016) 374: 20150182.
7. Ivanov P.Ch. and Bartsch R.P. Network Physiology: Mapping Interactions Between Networks of Physiologic Networks. In "Networks of Networks: the last Frontier of Complexity", edited by D'Agostino G and Scala A. Springer International Publishing Switzerland, Series Title 5394 Understanding Complex Systems, (2014): pp. 203-222
8. Ivanov P.Ch., et. al. Network Physiology: From Neural Plasticity to Organ Network Interactions. In "Emergent Complexity from Nonlinearity, in Physics, Engineering and the Life Sciences", edited by Mantica G, Stoop R, and Stramaglia S. Springer Proceedings in Physics (2017) 191: pp. 145-165