

## SESIÓN CIENTÍFICA 31 ENERO 2014 SALÓN DE ACTOS DEL CTB, 10:30

**"Theoretical modeling and simulations of dynamical behavior of biomedical systems. Research activities of the Laboratory for Computational Systems Biology, CTB".**

### **Ponentes:**

**Alexander Pisarchik ISPIP PhD:** Overview of activity. Synchronization of neurons with memory

**Adrian Navas:** Application of complex network theory to biomedical data

**Jose Antonio Villacorta PhD:** Dynamics of neuron networks

**Juan Garcia-Prieto:** Behavioral and MEG experiments with ambiguous images

**Mariano Alberto Muñoz:** Electronic implementation of complex systems

*(Each speaker will present for 10 minutes).*

**Alexander Pisarchik** is senior researcher of the UPM-BBVA Isaac y Peral BioTech programme, chair of the Laboratory of Computational Systems Biology. He obtained PhD in Physics and Mathematics in 1990 from Institute of Physics of the Belarus Academy of Science. His research interests include the theory of chaos, complex networks, synchronization, multistability and stochastic dynamics, with applications to biomedical systems. He has been honored with several awards including the First Prize from the Belarus Academy of Science and the Second Prize from the Institute of Physics for his studies on nonlinear dynamics of complex systems. In 2009-2011 he has been elected member of Evaluation Commission for System of National Researchers of the Council for Science and Technology in Mexico. The results of his research have been published in more than 300 scientific papers, including more than 130 articles in peer-reviewed journals, one book, 5 chapters in books, and 5 patents. He directed 20 research projects and supervised 10 PhD students. Citations (Google): 1357 total, h-factor: 23, i10 index: 49.

### **Selected publications:**

- **A.N. Pisarchik**, R. Jaimes-Reátegui, J.R. Villalobos-Salazar, J.H. Garcia-Lopez, S. Boccaletti. Synchronization of chaotic systems with coexisting attractors, *Phys. Rev. Lett.* **96**:244102 (2006).
- **A.N. Pisarchik**, O.N. Pochepen, L.A. Pisarchyk. Increasing blood glucose variability is a precursor of sepsis and mortality in burned patients, *PLoS One* **7**(10):e46582 (2012).

- **A.N. Pisarchik**, et al. Experimental implementation of a biometric laser synaptic sensor, *Sensors* **13** (2013).
- A.Yu. Simonov, S.Yu. Gordileeva, **A.N. Pisarchik**, V.B. Kazantsev. Uncertain phase synchronization of synaptically coupled neuron generators, *J. Exper. Theor. Phys. Lett.* **98**(10):707-712 (2013).
- **A.N. Pisarchik**, U. Feudel. Control of multistability, *Physics Reports* (in press).
- S. Boccaletti, **A.N. Pisarchik**. Synchronization: From Coupled Systems to Complex Networks (Cambridge University Press) (to appear in 2015).

**Adrian Navas** obtained master degrees in physics and complex systems from UCM and UPM respectively in 2011 and 2012. He now is a PhD student at the Laboratory of Computational Systems Biology at CTB, conducting his research on the theory of complex networks and application to data analysis.

#### Selected publications:

- Leyva, **A. Navas**, I. Sendiña-Nadal, J. M. Buldú, J. A. Almendral, S. Boccaletti, Synchronization waves in geometric networks, *Phys. Rev. E.* **84**, 065101 (R) (2011).
- Leyva, **A. Navas**, I. Sendiña-Nadal, J. A. Almendral, J. M. Buldú, M. Zanin, D. Papo, S. Boccaletti, Explosive transitions to synchronization in networks of phase oscillators, *Scientific reports* **3**:1281 (2013).
- **Navas**, et al. Functional hubs in mild cognitive impairment, *International Journal of Bifurcation and Chaos* (2013).
- Leyva, I. Sendiña-Nadal, J. A. Almendral, **A. Navas**, S. Olmi, S. Boccaletti, Explosive synchronization in weighted complex networks, *Phys. Rev. E.* **88**:042808 (2013).

**Jose Antonio Villacorta** obtained bachelor degrees in physics from UAM and in mathematics from UCM in 1996 and 2001, respectively, a master degree in neuroscience from UCM in 2005, and a PhD degree in neuroscience from UAM in 2007. Currently he holds a postdoctoral position at the Laboratory of Computational Systems Biology at CTB, conducting his research on neuron dynamics and complex network theory.

#### Selected publications:

- **Villacorta-Atienza J.A.**, Makarov V. Neural Network Architecture for Cognitive Navigation in Dynamic Environments. *IEEE Transactions on Neural Networks and Learning Systems* **24**(12):2075 – 2087 (2013).
- **Villacorta-Atienza J.A.**, Velarde M.G., Makarov V. Compact Internal representation of dynamic environments: Simple memory structures for complex situations, in: *Spatial Temporal Patterns for Action-Oriented Perception in Roving Robots II*. Ed. P. Arena. Springer, 2013.
- **Villacorta-Atienza J.A.**, Makarov V. Wave-processing of long-scale information in neuronal chains *PLoS ONE* **8**(2): e57440. doi:10.1371/journal.pone.0057440 (2013).

- Castellanos NP., Bajo R., Cuesta P., **Villacorta-Atienza J.A.**, Paúl N., del-Pozo F., Maestú F. Alteration and reorganization of functional networks: a new perspective in brain injury study. *Frontiers in Human Neuroscience* **5:90** (2011).
- **Villacorta-Atienza J.A.**, Velarde M.G., and Makarov V. Compact internal representation of dynamic situations: Neural network implementing the causality principle. *Biological Cybernetics* **103:285–297** (2010).

**Juan Garcia-Prieto** obtained a bachelor degree in electronic engineering in 2008 and a master degree in computer science in 2011 from UCM. He now is a PhD student at the Laboratory of Computational Systems Biology at CTB, carrying out experiments with magnetoencephalography (MEG).

**Mariano Alberto Muñoz** obtained bachelor degree in electronic engineering in 2011 from UCM. He now is a PhD student at the Laboratory of Computational Systems Biology at CTB, carrying out experiments with electronic circuits to simulate dynamics of complex systems.