

Last update: 07 June 2019 – 12:00 CEST

Keynote	Invited	Contributed	Other
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1 JULY

08:30-09:00		Welcome and registration
09:00-09:15	Manlio De Domenico (FBK)	Opening: National Coordinator CSS/Italy and Chair
09:15-09:30	Francesco Profumo (FBK)	President FBK
09:30-09:45	Guido Caldarelli (IMT Lucca)	President CSS
09:45-10:30	Riccardo Zecchina (U. "Bocconi")	<i>Complexity Science in the era of Big Data and Artificial Intelligence</i>
		TBD
10:30-11:00	Coffee break	
11:00-11:25	Daniela Paolotti (ISI Torino)	<i>It takes a village - how collaborations in complex systems and data science for social good can make a difference</i>
		The unprecedented opportunities provided by data science and complex systems in all the areas of human knowledge become even more evident when applied to the fields of social innovation, international development and humanitarian aid. Using social media data to study malnutrition and obesity in children in developing countries, using mobile phones digital traces to understand women mobility for safety and security, harvesting search engine queries to study suicide among young people in India: these are only a few of the examples of how data science can be exploited to solve issues around many social problems and support global agencies and policymakers in implementing better and more impactful policies and interventions. Nevertheless, scientists alone cannot be

		<p>successful in this complex effort. Greater access to data, more collaboration between public and private sector entities, and an increased ability to analyze datasets are needed to tackle these society's greatest challenges. In this talk, we will cover examples of how actors from different entities can join forces around data and knowledge to create public value with an impact on global societal issues and set the path to accelerate the harnessing of data science for social good.</p>
11:25-11:50	Giorgio Guzzetta (FBK)	<p><i>Reconstructing transmission chains to investigate spatiotemporal patterns of mosquito-borne infections</i></p> <p>Understanding the spatiotemporal dynamics of mosquito-borne infections is crucial to design and optimize control interventions. Bayesian inference methods can help in this task by reconstructing likely transmission chains (i.e., who infected whom), using information on the spatial location of cases and their time of symptom onset. We will present applications of such methods to dengue transmission from 2013-2016 in Porto Alegre, a metropolis in subtropical Brazil, and to the largest outbreak of chikungunya ever recorded in Europe to date, occurred in the summer of 2017 in Italy. These analyses provided quantitative information on the relationship between focal transmission (due to mosquito dispersal and walking-distance human movements) and the spread of infections at larger scale mediated by transportation-mediated human mobility (e.g. due to commuting and traveling), highlighting striking similarities between substantially different geographic and epidemiological contexts. Furthermore, we will show how insights obtained from the reconstruction of transmission chains can be applied to assess the effectiveness of public health measures aimed to contain the spread of mosquito-borne diseases.</p>
11:50-12:50	Indaco Biazzo (Politec. Torino)	<p><i>Bayesian framework for inference in epidemic processes on livestock movement networks</i></p>
	Carolina Becatti (IMT Lucca)	<p><i>Extracting significant signal of news consumption from social networks: the case of Twitter in the Italian political elections</i></p>
	Daniele Dall'Olio (U. of Bologna)	<p><i>Classification of Genome Wide Association data by Belief Propagation Neural network</i></p>

Carlo Mengucci (U. of Bologna)	<i>Introducing the Complex Human Interactions in MEDical Records and Atlases Network - CHIMERA</i>
Giulio Cimini (IMT Lucca)	<i>Unfolding the innovation system for the development of countries: co-evolution of Science, Technology and Production</i>

12:50-14:30 Lunch

14:30-15:53	Gloria Cecchini (U. of Florence)	<i>Analytical approach to network inference: investigating the degree distribution</i>
	Sebastian Raimondo (FBK)	<i>Measuring Network Features under Uncertainty</i>
	Carlo Giudicianni (U. "Luigi Vanvitelli")	<i>Complex Water Distribution Networks: How topology affects hydraulic systems?</i>
	Clara Rastelli (U. of Trento)	<i>Small-world properties of creative semantic networks in low and high fluid intelligence children</i>
	Gevorg Yeghikyan (SNS Pisa)	<i>Explaining urban mobility from urban features and morphology</i>
	Valeria D'Andrea (FBK)	<i>Human mobility as nonlinear dynamics driven by stochastic exogenous forcing</i>
	Antonio Scala (ISC/CNR)	<i>Sparse Decision Networks</i>

15:53-16:30 Coffee break

16:30-16:55	Enrico Bertuzzo (U. Cà Foscari)	<i>Ecological interactions in complex landscapes</i>
		Biodiversity is controlled by species specific traits and complex ecological interactions, yet universal macroecological patterns often emerge at large scales. Notable examples are the species area relationship and the elevational gradients of species richness. In this presentation, I investigate how the physical structure of the complex landscapes where species interactions take place could lead to emerging large scale patterns regardless of specific processes occurring at the local scale. The

		presentation focuses in particular on ecological processes occurring on fractal river networks and on the fluvial landscapes they form. First, a brief overview on drivers of biodiversity in river networks is provided. In the second part, the role of the geomorphology of mountains in shaping elevational gradients of species richness is investigated in more details.
16:55- 17:20	Carlos A. Plata (U. of Padua)	<i>Coupled effects of competition and neutrality in a model ecosystem</i>
	Deepak Gupta (U. of Padua)	<i>Pattern formation in niche space with two- and three-body interactions</i>
17:30- 18:30	Poster session & beers	
19:30- 20:30	Public Lecture: Guido Caldarelli (IMT Lucca)	<i>La scienza della complessità per affrontare le sfide del futuro</i>

Keynote

Invited

Contributed

Other

2 JULY

09:00-09:45	Amos Maritan (U. of Padua)	<i>From Data to Modelling and back: biodiversity in ecological communities</i>
		<p>Empirical observations show that ecological communities can have a huge number of coexisting species, also with few or limited number of resources. However, standard modeling of population dynamics based on consumer resource or Lotka-Volterra type of equations predicts that ecosystem stability should decrease as the number of species in the community increases and that the number of coexistent species is limited by the number of different type of available resources.</p> <p>In this talk I will show how cooperation and adaptation are key process to consider when modelling the population dynamics of microbial ecosystems. In the first part of the talk I will introduce adaptive consume resource models where metabolic strategies are dynamics and tend to maximize species' relative fitness. In the second part I will present a stochastic model which includes exploitative interactions as well as cooperative interactions induced by cross-feeding.</p> <p>Introducing adaptation and cooperation in the theoretical framework naturally leads to a solution of long-standing questions about complexity-stability and competitive exclusion paradox and on how highly biodiverse microbial communities can coexist in presence of only few resources.</p>
09:45-10:33	Samuele Stivanello (U. of Padua)	<i>Ecology of Human Activities</i>
Jacopo Grilli (ICTP)		<i>Macroecological laws across microbial communities</i>
Loren Kocillari (IIT)		<i>Variational principle for xylem's tapering in vascular plants</i>
Claudia Sala (U. of Bologna)		<i>Evolutionary model of protein domains in bacterial genomes</i>

10:33- **Coffee break**
11:00

11:00- Mario Di Bernardo (U. of
11:25 Naples “Federico II”)

Controlling collective behaviour in complex networks: perspectives, methodologies and applications

Network systems abound in Nature and play an important role in many technological applications, e.g. power grids, cooperative robotic networks, the internet, synthetic biology. Their complex structure together with the dynamics of the processes taking place on them can yield emergent collective behaviour which cannot be explained in terms of the individual node dynamics alone. A crucial example is the emergence of coordination and synchronization where all nodes in the network converge towards some common asymptotic solution. This talk will address the problem of designing feedback control strategies to engineer the emergence of some desired coordinated collective behaviour in complex networks and obtain appropriate conditions to select the control features in order to guarantee convergence. In particular, I will focus on recent developments by my group on distributed and decentralized strategies to control the collective behaviour of a network of interest towards synchronization and other types of coordinated behaviour.

I will highlight the role played by the structure of the network, the properties of the network nodes, and the control layers and describe some of the pressing open challenges that need to be faced in order to develop a coherent framework to achieve real-time feedback control of collective behaviour in complex network systems. I will illustrate the theoretical results through some application problems in Engineering and the Life Sciences that we are currently working on.

11:25- Tommaso Bellini (U. of Milan)
11:50

Molecular self-assembly and the Origin of Life

The phase diagram of aqueous solutions and mixtures of short and ultrashort oligomers of DNA and RNA is remarkably rich, and includes liquid crystal (LC) phases, gels, liquid-liquid and liquid-LC phase coexistence.

We recently found that a similar phase behavior, which includes LC ordering and phase separations, is also found in solutions of mononucleotides. Remarkably, we observe self-assembly only when the Watson-Crick pairing rule is obeyed, i.e. in solutions

		<p>containing A-T and C-G combinations. In these conditions, the mononucleotides arrange into columnar stacks of paired bases, a geometry that closely resembles the famed double helical structure. Thus, the Watson-Crick selective base pairing of DNA and RNA chains, at the basis of the storage and transfer of genetic information, follows from a mechanism already active at the level of the selective self-assembly of much simpler molecules.</p> <p>These, and other recent observations, suggest that DNA and RNA polymers could have emerged from the chemical variety of the early Earth through a combination of equilibrium and non-equilibrium processes, effectively catalyzing the chemical stabilization of their own self-assembled structure.</p>
11:50-12:50	Matteo Osella (U. of Torino)	<i>Statistical laws in complex component systems</i>
	Luca Dall'Asta (Politecnico di Torino)	<i>Statistical physics of coordination problems on networks: statics and dynamics</i>
	Marco Grassia (U. of Catania)	<i>Learning (sub-)optimal percolation with network dismantling</i>
	Michele Caselle (U. of Torino)	<i>A Birth-Death-Innovation model for the human regulatory network</i>
	Giulia Cencetti (U. of Florence)	<i>Pattern invariance for reaction-diffusion systems on complex networks</i>
12:50-14:30	Lunch	
14:30-14:55	Andrea Gabrielli (ISC/CNR)	<i>Statistical mechanics of weighted heterogeneous random (financial) networks</i>
		<p>In the last years the formulation of statistical ensembles of binary and weighted random graphs satisfying some arbitrary constraints has attracted much attention in phys/math communities for its two-fold potential application [1, 2]: (i) The construction of appropriate null models for the statistical validation of high order properties of real networks; (ii) the reconstruction of the statistical properties of real network starting for partial accessible information. The cornerstone of the</p>

statistical physics of complex networks is the idea that the links, and not the nodes, are the effective particles of the system. Here we formulate a mapping between weighted networks and lattice gasses, making the conceptual step forward of interpreting weighted links as particles with a generalised coordinate [3]. This leads to the definition of the grand canonical ensemble of weighted complex networks. We derive exact expressions for the partition function and thermodynamic quantities, both in the cases of global and local (i.e., node-specific) constraints on density and mean energy of particles. We further show that, when modeling real cases of networks, the binary and weighted statistics of the ensemble can be disentangled, leading to a simplified framework for a range of practical applications.

14:55- 15:55	Arsham Ghavasieh (FBK, Trento)	<i>Reducing Topological Redundancy Enhances Transport Properties in Interconnected Systems</i>
	Piero Mazzarisi (Scuola Normale Superiore, U. of Bologna)	<i>A dynamic network model with persistent links and node-specific latent variables, with an application to the interbank market</i>
	Federico Musciotto (U. of Palermo)	<i>Taking Census of physics</i>
	Oriol Artime (FBK, Trento)	<i>Cascade-based attacks on multilayer networks</i>

**15:55-
16:24** Coffee break

16:24- 17:00	Armando Bazzani (U. of Bologna)	<i>Statistical and dynamical properties of the bike mobility: The Bella Mossa data set in Bologna</i>
	Giulia Bertagnolli (FBK, Trento)	<i>Network depth: identifying median and contours in complex networks.</i>
	Giovanni Petri (ISI Foundation, Turin)	<i>Homological connectivity dynamics</i>

**17:00-
18:00** Poster session & beers

20:00- Social dinner
22:30

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3 JULY

09:00-09:45	Mathew Diamond (SISSA)	<p><i>Natural Intelligence: The surprising cognitive capacities of rats, and underlying neuronal substrates</i></p> <p>While neuroscientists are working assiduously to bring deep learning and other neural networks frameworks into the study of the brain, our argument will be that a flow of knowledge in the other direction will also be useful. The nervous system employs problem solving algorithms that have been tuned through millions of years of natural selection. Some of the perceptual and cognitive mechanisms of brain – what we call natural intelligence – could act as inspiration to purveyors of artificial intelligence. For the natural-to-artificial flow of knowledge to work, we need a deeper understanding of the capacities of humans and animals under controlled conditions. I will illustrate several behavioral paradigms in which rats display good capacities (sometimes approaching those of humans) and will present ongoing studies of the underlying neuronal circuits.</p>
09:45-10:10	Caterina La Porta (U. of Milan)	<p><i>Complexity in Biomedicine</i></p> <p>In this talk I will discuss recent advances in understanding phenotypic plasticity of cancer cells, highlighting the role of the epithelial mesenchymal transition for metastasis. To disentangle the complexity of environmentally induced phenotypic transitions, there is a growing need for novel advanced algorithms as those proposed in our recent work combining single cell data analysis and numerical simulations of gene regulatory networks. I will conclude discussing recent developments in artificial intelligence and its applications to personalized cancer treatment.</p>
10:10-11:00	Barbara Benigni (FBK, Trento)	<p><i>Exploring the interplay between brain and mind in Alzheimer's disease</i></p>

Eufemia Lella (U. of Bari)	<i>Communicability-based structural connectivity networks for the characterization of Alzheimer's disease</i>
Antonino Greco (U. of Trento)	<i>Brain dynamics during induced altered perceptual phenomenology revealed by multiscale permutation entropy and functional connectivity networks</i>
Ihusan Adam (U. of Florence)	<i>Unravelling the topological arrangements and selected reaction parameters from global measurements of an extended neural model</i>

**11:00-
11:30** Coffee break

11:30- 11:40	Mattia Frasca (U. of Catania)	SICC President
11:40- 11:50	Award	CSS/Italy Young Scientist Award
11:50- 12:00	Samir Suweis (U. of Padua)	Closing: National Vice-Coordinator CSS/Italy