Bollettino Settimanale

Lunedì 20 marzo 2017	Martedì 21 marzo 2017	Mercoledì 22 marzo 2017	Giovedì 23 marzo 2017	Venerdì 24 marzo 2017
AULA AMALDI ORE 14.00 **SEMINARIO TEORICO INFN** **Periodic and quasi-periodic attractors of the spin-orbit dynamics of Mercury** *Prof. Guido Gentile (Università di Roma Tre)* Mercury is entrapped in a 3:2 resonance: it rotates on its axis three times for every two revolutions it makes around the Sun. The mathematical model commonly used to study the problem proved not to be entirely convincing, because of the expression used for the tidal torque. Only recently, a model for the tidal torque has been proposed which has the advantage of being more realistic and providing a higher probability of capture into the 3:2 resonance. A drawback of the model is that the function describing the tidal torque appears as a superposition of peaks, so that both analytical and numerical computations are rather delicate. We shall present numerical and analytical results, which provide evidence that the librations of Mercury's spin in the 3:2 resonance are quasi-periodic in time, so that the very concept of resonance should be revisited. **AULA CONVERSI ORE 14.00** **SEMINARIO INFN-Sperimentale particelle elementari** **Negative Ion Time Projection Chambers for very rare events searches** *Elisabetta Baracchini (INFN LNF)* Two of the most compelling questions of fundamental physics today are the nature of Dark Matter and the properties of neutrinos. These topics involve the study of very rare processes and share the same challenging requirements on the simultaneous optimization of the active volume, energy resolution and background rejection capabilities of the detector. I will discuss how a gaseous TPC with negative ion drift can potentially provide the best observables for rare event searches, guaranteeing impressive background rejection and fiducialization capability. I will illustrate the current R&D effort going on in Italy and the most recent results obtained. To conclude, I will show how we plan to put into effect the R&D work done during the recent years in a new project “UNDER: Underground Neutron DEtection through nuclear Recoil”, for a background-free measurement of the fast and thermal neutron flux in Hall B of Laboratori Nazionali del Gran Sasso. **AULA 3 ORE 14.30** **SEMINARIO DI FISICA STATISTICA** **Chasing memories** *Prof. Anita Mehta (Calcutta University)* Short- and long-term memories are distinguished by their forgettability. Most of what we perceive and store is lost rather quickly to noise, as new sensations replace older ones, while some memories last for as long as we live. Synaptic dynamics is key to the process of memory storage; in this talk I will discuss a few approaches we have taken to this problem, culminating in a model of synaptic networks containing both cooperative and competitive dynamics. It turns out that the _competition_ between synapses is key to the natural emergence of long-term memory in this model, as in reality.	AULA CONVERSI ORE 16.00 SEMINARIO GENERALE **Scale-free optics: Cancelling and inverting diffraction below the optical wavelength** *Eugenio Del Re Eugenio* *(Sapienza Università di Roma)* At the wavelength scale, optical propagation is dominated by diffraction that distorts fine details in the field, setting limits to imaging instruments, such as microscopes and telescopes. For subwavelength perturbations, only evanescent waves are excited so that no image is actually able to leave the emitting plane. Although waveguides and spatial solitons can compensate diffraction for specific waveforms, they can neither be used to transmit an arbitrary image not can they achieve subwavelength propagation.In recent years we have discovered a new regime in which the laws of optical propagation can be profoundly modified by so-called shape-sensitive nonlinearities, that is, nonlinearitites that depend on the shape but not on the actual intensity. In these systems, light can be made to obey a modified Helmholtz equation where diffraction is cancelled and no evanescent waves exist, so that subwavelength perturbations are observed to propagate undistorted for macroscopic distances. We will discuss the underlying physics, the different experimental demonstrations in nanodisordered photorefractive ferroelectrics, and future developments and applications.	**AULA CONVERSI ORE 16.00** **SEMINARIO TEORICO** **Quantum symmetries of flat quantum spacetime** *Jerzy Kowalski-Glikman* *(University of Wroclaw)* By applying the Loop Quantum Gravity techniques we recently showed that in 3 dimensions the symmetry of flat spacetime in quantum gravity becomes a non-trivial Hopf algebra deformation of the Poincare algebra, known as kappa-Poincare algebra. In my talk I will describe the steps that led us to this result and then I will briefly discuss its consequences for the theory of quantum gravity and quantum gravity phenomenology.	**SALA LAUREE ORE 15.00** **SEMINARIO STRUTTURA DELLA MATERIA** **Maximum entropy for economic and brain networks: network reconstruction, early-warning signals, and module detection** *Massino Garlaschelli* *(University of Leiden)* In many cases of practical relevance, one needs to construct ensembles of random networks, or random time series, that obey specified constraints. In these cases, the maximum entropy construction is a natural recipe to generate randomness, however the presence of several heterogeneous constraints leads to important differences with respect to the traditional construction. For instance, in order to reliably estimate the risk of collapse of a financial system, one needs to infer the network of linkages between banks and/or firms, but this network is empirically unaccessible due to confidentiality. One therefore has to reconstruct the network from partial, publicly available information about individual financial institutions. I will discuss various maximum-entropy network reconstruction methods, highlighting the importance of capturing the heterogeneity of the constraints correctly. I will also discuss how ensembles of reconstructed networks can be used as models of trade networks and as benchmarks to detect early-warning signals of upcoming crises in empirical interbank networks. Then, I will shortly describe maximum-entropy ensembles of constrained time series, and use their properties to empirically identify communities of correlated stocks in financial markets and functional modules of correlated neurons in the brain. I will conclude showing that, in all the cases considered, the presence of an extensive number of constraints leads to a surprising breaking of the equivalence between canonical and microcanonical ensembles, with important consequences for the statistical physics of systems with many constraints.	