CONFERENCIA DE APERTURA

Martes 26 de septiembre

9:00	Edificio Anexo del Senado	Hall Central

Innovation in materials & processes
How to change a good idea into a good product

Henning Zoz[1]

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Great ideas and potential innovations are suffering with respect to market introduction on large barriers: innovation hesitation of the society, risk and fear and other. Insofar the quantitative promise/expectation of benefit determines the driving force from the innovation itself. The higher the expected benefit of a "better solution."against given solutions, the better the chances for a market introduction In case of "new solutions", usually there is no market which can slow down or end the innovation for years or even decades.

The environment likewise the given market determines the barriers at its levels. The more modern and developed the society is, the higher are such barriers which is represented by regulations and standards but also by availablity "close to satisfaction". e.g. cleantech for transportation suffers on the very cost effective/high quality (even including very clean) availability of fossil based transportation/automotive technology and infrastructure. About 135 years ago, the first commercial combustion engine did operate a few hours in lifespan, today a fuelcell is required to operate thousands of hours under extreme safety requirements/regulations particularly with respect to hydrogen. Realistically, if somebody today would like to register gasoline or aspirin for the first time for commercial application - for sure he would run into huge barriers as well - however, society is used to those materials and processes.

Back to fossile transportation, even the political driven and not very scientific nor realistic horror scenario around CO_2/Carbon Footprint/IPCC could and cannot help. And there is nothing wrong with carbon but fossiles since a hundred years are too good and too short just for burning them away. There is something wrong with the mentioned political activities since we do not need an expensive green religion as/if we have already green technology.

If it comes to "good ideas", SMEs by nature are the better innovators even they are missing capital and infrastructure background for the needed market approach compared to huge organizations and large industry. For any good idea we still need to think - and still only the single human beeing can think where conglomerates and groups can only vote. Insofar the general policy of our modern world in terms of innovation support focussig mostly on SMEs is to be very much appreciated. However, innovation cannot be ordered. Only potential benefits as well as given barriers can be worked on.

After such philosophical attempt, the present presentation will focus on examples at Zoz Group, a small SME originally and still today focussing on the manufacturing of equipment for High Kinetic Processing (HKP) with the core product Simoloyer® - the nanostructure making device.

The Simoloyer® (left) and resulting nanostructure and innovative solutions in green-/cleantech - manufactured with Zoz Technology

P2H® | P2G2F® | Hydrolium® | H2Tank2Go® | Zentallium® | ZoLiBat® | Simoloyer® are registered trademarks of Zoz Group, Taraxagum™ is so of Continental AG

At first nobody wanted such equipment since nobody needed nanostructures. Thus Zoz started utilizing it's own product and in result today became aditionally a global player particularly in green/clean tech applications answering the question "how to make more with less" to the benefit of mankind and environment.

The "Zoz-example" in brief will include super light-weight (Zentallium®), better magnetic material (Zoz-NdFeB), better and cleaner concrete (FuturZement, FuturBeton) better energy storage material, both, electro-chemical (ZoLiBat®) and solid state hydrogen storage (Hydrolium®, H2Tank2Go®, P2G2F®, P2H®), better anti-cossosive material (Zoz-zincflake-paint), better target material for both, optical and magnetic data storage, Nanostructured Ferritic Alloys (next gen. ODS) at better irradiation damage resistance for high temperatur (GE and Zoz) and even generating high quality rubber from the roots of dandelion plants in tonnage range (Fraunhofer-IME, Continental and Zoz).

CONFERENCIAS PLENARIAS

Martes 26 de septiembre

10:00	Edificio Anexo del Senado	Hall Central

Quantum information theory with black boxes

Antonio Acín[1]

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Device-independent quantum information processing represents a new framework for quantum information applications in which devices are just seen as quantum black boxes processing classical information. This level of abstraction makes device-independent protocols especially relevant for cryptographic applications, as existing quantum hacking attacks become impossible. After introducing the key ideas and concepts needed for the definition of the device-independent scenario, we review the main results and open questions and discuss how this new approach also sheds light on fundamental questions in quantum physics.

11:30	Edificio Anexo del Senado	Hall Central

Abriendo caminos para las tecnologías cuánticas

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El desarrollo de tecnologías cuánticas es un campo de gran crecimiento e importancia actual. Propiedades específicas de sistemas cuánticos son explotadas para mejorar el desempeño de numerosas aplicaciones que requieren la transmisión, el proceso y/o monitoreo de la información cuántica. Estas tecnologías sirven por ejemplo para simular sistemas cuánticos, para hacer cómputos complejos de forma más rápida que con las computadoras clásicas convencionales o para usarlos como sensores a escalas nanométricas de particular interés en biología y medicina.

El gran desafío a afrontar para el desarrollo de estas nuevas tecnologías, es que los sistemas cuánticos son muy sensibles al medioambiente con el cual inevitablemente interactúan. Estas interacciones degradan las propiedades cuánticas indispensables para estas nuevas tecnologías, como las coherencias o el entrelazamiento cuántico. Es esencial entonces controlar la interacción entre el dispositivo y su medio ambiente para suprimir los efectos indeseados del ambiente, mientras que la interacción necesaria para que los dispositivos funcionen se mantenga.

En el seminario presentaré algunos desafíos a afrontar para el desarrollo de tecnologías cuánticas, y diferentes técnicas que se han desarrollado para este propósito en diversas áreas de la física, incluyendo resonancia magnética, óptica e información cuántica [1]. Además, comentaré sobre las aplicaciones que han derivado de estas técnicas, como por ejemplo el uso de sensores cuánticos de procesos físicos, químicos y biológicos a escalas nanométricas [2-9].

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16:30 | Edificio Anexo del Senado | Hall Central

Interfacial instabilities of bubbles in confined geometries

Anne Juel[1]

[1] Manchester Centre for Nonlinear Dynamics and School of Physics & Astronomy, University of Manchester, Manchester, UK.

What links a baby's first breath to adhesive debonding, enhanced oil recovery, or even drop-on-demand devices? All these processes involve moving or expanding bubbles displacing fluid in a confined space, bounded by either rigid or elastic walls. In this talk, we show how spatial confinement may either induce or suppress interfacial instabilities and pattern formation in such flows.

We demonstrate that a simple change in the bounding geometry of the containing vessel, e.g. a small height constriction within the cross-section of a rectangular channel, can radically alter the behavior of a fluid-displacing air bubbles and fingers. A rich array of propagation modes, including symmetric, asymmetric and localized fingers, is uncovered when air displaces oil from axially uniform tubes that have local variations in flow resistance within their cross-sections. An unexpected and novel propagation mode exhibits spatial oscillations formed by periodic sideways motion of the interface at a fixed relative distance behind the moving finger-tip. We apply these findings to passively sort bubbles by size. We support our experimental findings with a complementary analysis based on a depth-averaged theory. The theoretical study reveals that the exchange of stability between different modes of bubble propagation relies on non-trivial interactions between capillary and viscous forces.

Viscous fingering in Hele-Shaw cells is an archetype for front propagation and pattern formation: when air is injected into the narrow, liquid-filled gap between parallel rigid plates, the propagating air-liquid interface is unstable to deformation with a maximum unstable wavenumber set by the ratio of viscous to surface tension forces. We show how the introduction of wall elasticity (via the replacement of the upper bounding plate by an elastic membrane) can weaken or even suppress the fingering instability by allowing changes in cell confinement through the formation of axial depth gradients from the deflection of the membrane.

Miércoles 27 de septiembre

9:00	Centro Cultural Pasaje Dardo Rocha	Auditorio

The long journey to the Higgs boson and beyond at the CERN LHC

Peter Jenni[1]

[1] University of Freiburg, Germany & CERN, Geneva, Switzerland

The discovery of the Higgs boson in July 2012 was the result of a long and fascinating story at the Large Hadron Collider at CERN. Building up the experimental programme with this unique high-energy collider, and developing the very sophisticated detectors built and operated by world-wide collaborations, meant an incredible scientific and human adventure, spanning more than three decades. The LHC has to be seen as a global project with its three pillars: the collider, the experiments, and the grid-computing infrastructure, all this of course motivated by the underlying physics theory of the Standard Model (SM) of particle physics, as well as the search for windows into New Physics beyond the SM. In the first part this talk will recall the initial motivation for the project, tracing its history, as well as illustrate some of the many milestones that finally led to the Higgs boson discovery by the ATLAS and CMS Collaborations some 5 years ago, including the two Argentina ATLAS teams from UBA and UNLP. In the second part the focus of the talk will shift to new ATLAS results, including also very recent analyses from the ongoing 13 TeV Run-2 of LHC. These concern both improved measurements on the fundamental properties of the Higgs boson as well as examples of searches for physics beyond the SM. And this is only the beginning of a fantastic journey into unchartered physics territory with the LHC, which will be pursued with an upgraded collider and improved detectors for two decades to come, leading into the high-luminosity LHC phase.

10:00 Centro Cultural Pasaje Dardo Rocha Auditorio

El proyecto QUBIC en Argentina: búsqueda de huellas de ondas gravitacionales en la polarización de la radiación cósmica de fondo

Beatriz Garcia [1], en nombre de la colaboración Argentina en QUBIC

[1] ITeDAM-CONICET-CNEA-UNSAM, UTN Facultad Mendoza, Lab. Pierre Auger, Argentina

La cosmología moderna ha mostrado ser un área de investigación con grandes desafíos. La detección de modos B primordiales en la radiación de fondo cósmico podría representar un logro sin precedentes para la consolidación de la teoría inflacionaria de origen y evolución del Universo y revelaría la presencia de ondas gravitacionales producidas en la era de Planck.

Sin embargo el tratamiento de las incertezas sistemáticas provenientes de las observaciones se ha transformado en un tema tan importante como el de la detección. En este sentido, la interferometría ofrece un control mejorado de la sistemática instrumental a través de la observación de franjas de interferencia que se pueden calibrar individualmente. Por su parte, el uso de detectores bolométricos permite alcanzar una sensibilidad comparable a la de un detector con un gran número de receptores. QUBIC (Q & U Bolometric Interferometer) es un nuevo tipo de instrumento que combina la sensibilidad requerida a partir de los Transition-Edge-Sensors (TES) y el control de los errores sistemáticos a partir de la observación de patrones de franjas de interferencia. Funcionará en dos frecuencias diferentes para ayudar a discriminar entre la emisión polarizada del polvo galáctico de aquella relacionada con el modo B primordial. Originalmente previsto para ser instalado en la estación Concordia en Antártida, en abril de 2016 la colaboración internacional en el proyecto decidió la instalación del primer módulo en Alto Chorrillos, provincia de Salta.

Jueves 28 de septiembre

9:00	Centro Cultural Pasaje Dardo Rocha	Auditorio

Modelización a partir de cálculos de primeros principios de procesos fisicoquímicos sobre superficies: desde la adsorción hasta la funcionalización

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[1] Instituto de Física Rosario, CONICET - Universidad Nacional de Rosario, Rosario, Argentina

En esta presentación se ilustrará a través de varios ejemplos, el estado del arte de la modelización teórica de varios procesos fisicoquímicos sobre superficies. Se discutirán en detalle posibles mecanismos de adsorción de moléculas pequeñas sobre superficies metálicas limpias y la relevancia de los diferentes mecanismos de transferencia de energía entre la molécula y la superficie, el efecto de la presencia de especies preadsorbidas, la posibilidad de modificar la reactividad de una superficie a través de la preparación controlada de aleaciones superficiales bimetálicas y el papel relativo de las interacciones molécula-superficie y molécula-molécula en las posibles estructuras que moléculas orgánicas más complejas forman a escala nanométrica (auto-organización). Se mostrará además, cómo a través de la comparación directa de este tipo de simulaciones con resultados experimentales de caracterización estructural de superficies en ultra alto vacío, desorción térmica programada, con haces moleculares supersónicos, es posible contribuir al desarrollo de nuevas funcionales de intercambio y correlación electrónica en la que reside la aproximación central dentro de la Teoría de la Funcional Densidad, la herramienta teórica estándar hoy en día para la descripción de sistemas molécula-superficie.

Viernes 29 de septiembre

9:00	Centro Cultural Pasaje Dardo Rocha	Auditorio

On the quest of superconductivity at room temperature at graphite interfaces

Pablo D. Esquinazi[1]

[1] Division of Superconductivity and Magnetism, Felix-Bloch Institute for Solid State Physics, Universität Leipzig, Leipzig, Germany

Superconductivity is the phenomenon in nature where the electrical resistance of a conducting sample vanishes completely below a certain temperature, the "critical temperature T_c". Superconductivity, discovered in 1911, is one of the most studied phenomena in experimental and theoretical solid state physics. It has important applications, like the generation of high magnetic fields using superconducting solenoids cooled at liquid He (4K) up to liquid nitrogen (77K) temperatures, or the use of extremely sensitive magnetic field sensors via the Josephson effect. Among solid state physicists there exists a kind of unproven law regarding the (im)possibility to have superconductivity at room temperature, which means to have a material with a $T_c > 300$K. This over-skepticism is the reason why no systematic search for this phenomenon in graphite was done for several decades after the work of Kazimierz Antonowicz [1]. Different measurements done in the last 17 years in oriented pyrolytic graphite, graphite powders [2] and natural graphite [3], however, strongly suggest that room temperature superconductivity is localized at some interfaces in the graphite structure. This may explain several aspects of this hidden superconductivity, like low reproducibility, time instability, small amount of superconducting mass and the difficulty to localize the superconducting phase(s).

Theoretical work indicates that at certain graphite interfaces a dispersion-less relation, a flat band, for conduction electrons exists, which would strongly enhance the critical temperature. The talk summaries old and new experimental facts, which speak for the existence of superconductivity with a critical temperature above 350 K in graphite.

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10:00	Centro Cultural Pasaje Dardo Rocha	Auditorio

Temperature, susceptibility and transport in an experimental non-equilibrium steady-state

Jean-Christophe Géminard[1]

[1] CNRS, ENS de Lyon, Laboratoire de Physique, Lyon, France

Statistical mechanics, which uses probability theory to study the average behaviour of mechanical systems composed of many bodies, proved to be a fruitful extension of classical thermodynamics to describe the properties of equilibrium systems. In nature, however, out-of-equilibrium systems are widespread, which explains the efforts produced during the last decades to develop theoretical tools adapted to systems in which energy conservation, for instance, is not satisfied. Dissipative systems spontaneously tend to come to rest. However, non-equilibrium steady states (NESS) can be acchieved by continuously injecting energy in the system, in order to compensate the intrinsic dissipation.

We achieve a granular gas, the NESS, by shaking a collection of millimetric beads in a container. A blade, fastened to the shaft of a small DC-motor and immersed in the grains, behaves as a driven 1D Brownian rotator. Thanks to its electromechanical reversibility, the motor is used as both actuator and sensor, simultaneously.

On the one hand, we focus on potential definitions of the temperature of our system, first based on the Gallavotti-Cohen fluctuation theorem (asymmetry of the energy exchanges between rotator and the NESS), and second on the fluctuation-dissipation theorem (relation between the spontaneous fluctuations and the response to a weak perturbation). Both methods give nicely concordant results.

On the other hand, we duplicate the system, couple two granular gases by simply connecting the DC-motors to one another and report on the energy transport through the probes in contact. First, we show that the energy flux from one probe to another is, in temporal average, proportional to the temperature difference. Second, we observe that the instantaneous flux is highly intermittent and that fluctuations exhibit an asymmetry which increases with the temperature difference. This asymmetry, related to irreversibility, is correctly accounted for by a relation strongly evoking the Fluctuation Theorem.

11:30	Centro Cultural Pasaje Dardo Rocha	Auditorio

Estados topológicos en sistemas magnéticos

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Los sistemas magnéticos correspondientes a momentos magnéticos localizados dan lugar en general a bajas temperaturas a fases con diferentes tipos de orden magnético (ferromagnético, anti-ferromagnético etc.). Sin embargo, cuando hay varios tipos de interacciones entre los momentos magnéticos que compiten entre si, puede ocurrir que emerjan estados (en general no magnéticos) con propiedades topológicas particulares. Se trata en general de sistemas donde la mecánica cuántica juega un papel preponderante en la naturaleza topológica del estado. En esta charla estudiaremos algunos ejemplos de dichos sistemas y trataremos de explicar para cada uno de ellos las propiedades topológicas de los estados de baja energía.

12:30	Centro Cultural Pasaje Dardo Rocha	Auditorio

Nano-óptica con nanopartículas coloidales y moléculas fluorescentes

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Tradicionalmente la luz se ha manipulado en regiones macroscópicas con elementos reflectivos y refractivos. En las últimas décadas, el estudio y control de la luz en regiones del espacio con dimensiones menores a la longitud de onda se ha visto impulsado por la demanda de i) dispositivos de computación más rápidos, pequeños y altamente integrados, ii) sensores biomédicos y ambientales ultrasensibles, y iii) métodos ópticos de visualización con resolución espacial nanométrica.

La nano-óptica apunta a obtener un conocimiento profundo de la interacción luz-materia en la nanoescala. Para ello se requiere de métodos que brinden control nanométrico en la fabricación y posicionamiento de materiales nano-estructurados y moléculas. Existen numerosos esfuerzos para construir nano-dispositivos ópticos usando metodologías top-down, derivadas de la tecnología que se usa actualmente en la industria de semiconductores. Sin embargo, esta tecnología tiene varias limitaciones: no permite fácilmente la combinación de distintos materiales, no aprovecha la enorme librería de nanomateriales disponibles por química coloidal, y no permite la incorporación de moléculas foto-activas con control estequiométrico. En esta charla presentaré con ejemplos de nuestro laboratorio dos metodologías de nanofabricación que brindan soluciones a estos desafíos: la impresión óptica de nanopartículas coloidales [1,2] y el origami de ADN [3,4].

Por otro lado, presentaré un nuevo método de nanoscopía de fluorescencia que permite obtener de manera rutinaria imágenes con resolución espacial de 1 nm [5], que corresponde al tamaño típico de una molécula fluorescente, es decir la máxima resolución espacial con sentido físico para un método óptico.

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