

## VALIDATION

Ces cours peuvent donner droit à des crédits ECTS, veuillez vous renseigner auprès de votre haute école de rattachement.

## PHYSIQUE THÉORIQUE

- Quantum Optics and Ultracold Atoms** ■ **Alain Aspect**, CNRS, Paris, France  
 This course will review several aspects of the effects of quantum mechanics in optics. The first example is the possibility of realizing quantum entanglement, allowing to check the basic principles of quantum mechanics (Bell inequalities). Another aspect is the possibility to use optical traps to cool atomic gases and to realize quantum condensates, in which phenomena such as Bose-Einstein condensation can be obtained. These systems provide unique experimental realizations, with an unparalleled degree of control to check for effect of interactions or external perturbations such as disorder on quantum particles.  
 Les jeudis 19, 26 février, 5, 12 mars 2009 de 14h15 à 18h00 ■ EPFL, Lausanne, Centre Ouest, salle CO 015
- Nonperturbative Methods in QFT : Instantons and Large  $N$**  ■ **Marcos Marino**, Université de Genève  
 1) Instantons in quantum mechanics: the anharmonic oscillator; general potentials; multi-instantons.  
 2) Unstable vacua in field theory: decay of the  $\Phi^4$  theory; cosmological applications; gravitational instabilities.  
 3) Large order behavior in perturbation theory and instantons: divergent series and Borel summability; instantons and large order behavior in quantum mechanics; large order behaviour in QFT renormalons.  
 4) Instantons in gauge theories: properties and dynamical effects: euclidean Yang-Mills instantons; the gauge theory vacuum; instantons and the  $U(1)$  problem; instantons and confinement; instantons in supersymmetric gauge theories.  
 5) The  $1/N$  expansion: double-line diagrams and the  $1/N$  expansion; the master field; examples in low dimensions: matrix models;  $CP^N$  model, 2d QCD.  
 6) Some uses of the  $1/N$  expansion: mesons and baryons at large  $N$ ; Witten-Veneziano formula; instantons and large  $N$ ; Large  $N$  and string theory.  
 Les jeudis 26 février, 5, 12, 26 mars, 2, 9 avril 2009 de 14h15 à 18h00 ■ Université de Genève, Ecole de Physique, Quai E.-Ansermet 24, auditoire Stückelberg (rez)
- Application de la théorie des champs quantique non-relativiste à la condensation de Bose-Einstein avec faible interaction répulsive** ■ **Jean Zinn-Justin**, CEA Saclay, Gif-sur-Yvette, France  
 Condensation de BE: effet d'une faible perturbation. Réduction à la théorie des champs  $\phi^4$  statistique classique dans le voisinage du point de transition. Analyse par le groupe de renormalisation: de la condensation de Bose-Einstein à la transition de l'Helium superfluide. Solution de la théorie  $\phi^4$  à  $N$  composantes pour  $N$  grand. Application au calcul de la température de travail dans la limite d'une interaction faible.  
 Les jeudis 2, 9, 23, 30 avril, 7 mai 2009 de 14h15 à 18h00 ■ EPFL, Lausanne, Centre Ouest, salle CO 015

## PHYSIQUE NUCLÉAIRE &amp; CORPUSCULAIRE

- Gaseous Detectors in High Energy Physics** ■ **Archana Sharma**, CERN, Genève  
 These lectures will be devoted to studying gaseous particle detectors and detection techniques. Beginning with a historic overview of detector development basic techniques and concepts for particle detection will be discussed. Different detector types used for tracking, energy measurement and particle identification including recent developments of two areas of research: resistive plate chambers, aiming at best time resolution, and micro-pattern chambers, designed for high rate tracking in hostile environments will be covered. Emphasis will be put on the progress in basic understanding of the operating features, and of the underlying physical processes. Some examples of applications of detectors outside particle physics will also be provided.  
 Les jeudis 5, 12, 19, 26 mars 2009 de 14h15 à 18h00 ■ EPFL, Lausanne, Centre Est, salle CE 1104
- High Energy Gamma Rays** ■ **B. Walter** (Observatoire Genève), **M. Ribordy** (EPFL), **A. Biland** (ETHZ)  
 Astrophysics of high energy photon sources; Source classification and physical properties of gamma ray emission; Variable sources like GRB, pulsars, etc.; Discussion of observables and relations to photon properties; Detection techniques for high energy gamma rays: satellite detection, atmospheric detection; Multi-messenger techniques (CR, gamma, neutrino).  
 Les jeudis 23, 30 avril, 7, 14, 28 mai 2009 de 14h15 à 18h00 ■ EPFL, Lausanne, Centre Ouest, salle CO 010

## PHYSIQUE DE LA MATIÈRE CONDENSÉE

- The Polymer Physics of DNA** ■ **Bertrand Duplantier**, CEA Saclay, Gif-sur-Yvette, France  
 Brownian Motion. The Ideal Polymer Chain. Discrete Models of Chains. Polymers in Solution. Single-Molecule Manipulation: the Semi-flexible Chain Model of the DNA. The Topology of DNA and the Topoisomerases. Transient Violations of the Second Principle and the folding of RNA.  
 Les jeudis 19, 26 février, 5, 12 mars 2009, de 14h15 à 18h00 ■ EPFL, Lausanne, Centre Ouest, salle CO 010
- Fluctuations in Conventional and High-Tc Superconductors** ■ **Felix Vidal**, Universidade de Santiago de Compostela, Espagne  
 The effects around the superconducting transition of thermal fluctuations of Cooper pairs on the heat capacity in zero applied magnetic fields ( $H=0$ ) are explicitly calculated in bilayered superconductors, with two superconducting layers and tunneling couplings per layer periodicity length. The calculations are performed on the grounds of a generalization to multilayered superconductors of the Lawrence-Doniach Ginzburg-Landau functional, and assuming Gaussian fluctuations. In addition to the fluctuation heat capacity  $c_f$ , we also obtain various useful relationships between  $c_f$  and other fluctuation-induced observables experimentally accessible in multilayered copper oxide superconductors. It is then shown that if the effects of the multilaminarity are taken into account, the mean-field-like Gaussian-Ginzburg-Landau approach may explain simultaneously and at a quantitative level the available experimental data.  
 Les jeudis 12 et 19 mars 2009 de 14h15 à 18h00 ■ EPFL, Lausanne, Centre Est, salle CE 1100
- Mechanics of Proteins and Enzymes: A stochastic coarse-grained approach** ■ **Cristian Micheletti**, Sissa, Trieste, Italie  
 Introduction and motivation: collective fluctuations in proteins and biological functionality using stochastic coarse-grained approach. The course starts with the calculation of the mean-square velocity and velocity-autocorrelation function for diffusing particles in the underdamped and overdamped limits. Then it considers the principal component analysis of molecular dynamics simulations of proteins and identifies collective functional movements of enzymes. Modeling of the protein's collective movements with coupled stochastic oscillators will be introduced using elastic network models.  
 Les jeudis 19, 26 mars, 2, 9 avril 2009 de 14h15 à 18h00 ■ EPFL, Lausanne, Centre Ouest, salle CO 010
- NMR in Correlated Electron Materials** ■ **Henri Alloul**, Université Paris-Sud, Orsay, France  
 Principles of NMR will be reviewed and experimental data and theoretical models critically examined for a range of correlated electron materials. The emphasis will be to prepare the doctoral students join in the new research areas using the basics of the NMR technique and our present understanding of advanced condensed matter physics.  
 Les jeudis 23, 30 avril, 7, 14 mai 2009 de 14h15 à 18h00 ■ EPFL, Lausanne, Centre Ouest, salle CO 011
- Molecular attractions** ■ **Rudolf Podgornik**, University of Ljubljana, Slovénie  
 The three most important sources of attractive interactions (van der Waals, electrostatic, and bridging interactions) in soft matter systems will be introduced and applied to specific model systems, like multilamellar lipid systems, DNA collapse in presence of multivalent ions and the organization of the genome.  
 Les jeudis 30 avril, 7, 14, 28 mai 2009 de 14h15 à 18h00 ■ EPFL, Lausanne, Centre Est, salle CE 1104

## COURS DE BASE

- Le Modèle Standard (suite du cours débuté en décembre 2008)** ■ **Geneviève Bélanger**, LAPTH, Annecy-le-Vieux, France  
 Interactions électrofaibles des quarks et leptons, bosons de jauge et bosons de Higgs, interactions fortes.  
 Renormalisation de la charge, évolution des constantes de couplage : liberté asymptotique et unification.  
 Les jeudis 19, 26 février, 5, 12, 19, 26 mars, 2, 9, 23, 30 avril 2009 de 9h15 à 13h00. ■ EPFL, Lausanne, Centre Ouest, salle CO 010

## SEMINAIRE TRANSALPIN 2009


**Climate and Atmospheric Physics** (<http://seminairetransalpin.in2p3.fr/2009>)

The course is designed to familiarize physics students with the basics of physics as applied to the atmosphere and the climate system. The governing equations will be presented, including turbulence and atmospheric radiation. Applications of these basic laws of physics to particular processes and the manner in which they can be used for observing the climate system or atmospheric pollution will enable students to understand the intricacies of the atmosphere.

**Speakers:** M. Beniston / G. Boffetta / C. Cassardo / C. George / S. Goyette / J.-Y. Grandpeix / P. Laj / A. Mazzino / M. Onorato / R. Perkins / A. Provenzale / P. Rairoux / D.B. Stephenson / J.-P. Wolf

1-6 février 2009 ■ Champex-Lac, Valais, Suisse

Les cours organisés dans le cadre du Troisième cycle de la physique en Suisse romande sont destinés aux candidats au doctorat, aux professeurs et chercheurs des instituts associés, aux maîtres de l'enseignement secondaire, ainsi qu'aux chercheurs de l'industrie. L'inscription se fait auprès de l'assistant à chaque leçon. Les informations concernant le Troisième cycle de physique sont disponibles à <http://www.cuso.ch>.

Le programme ci-dessus est sujet à modifications. Les changements sont indiqués sous <http://www.cuso.ch/3e-cycle/physique.html>.