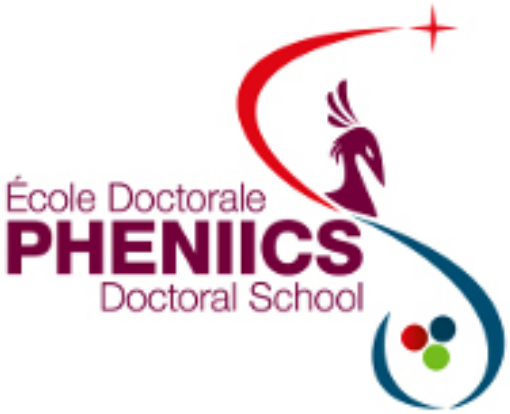
PHENIICS Doctoral School Days



Report of Contributions

Contribution ID: **0** Type: **Poster**

Novel applications and future perspectives of a fast diamond gamma ray detector

Monday, May 9, 2016 3:30 PM (1 hour)

For the first time, a diamond sensor was operated for the characterisation of a high average-intensity gamma-ray beam.
Data was collected for gamma beam energies between 2 and 7 MeV, at the HIγS facility of TUNL.
The nanosecond-fast resolution of diamond detectors is exploited to distinguish bunches of gamma rays 16.8 ns apart.
It allows a precise direct determination of the time-structure of the gamma beam.
The strong potential of such a detector for precise absolute flux, position and polarisation measurements is exposed.
It is thus shown that diamond detectors are a decisive and unique tool for the detailed characterisation of upcoming gamma sources, such as ELI-NP and HIγS-2, which will revolutionise the future of nuclear physics.

Author: Mr WILLIAMS, Themistoklis (LAL)

Presenter: Mr WILLIAMS, Themistoklis (LAL)

Session Classification: Poster session

Track Classification: Accelerator Physics

Contribution ID: **3** Type: **Oral Presentation**

Deep inelastic reactions at intermediate energies above the Coulomb barrier

Tuesday, May 10, 2016 2:45 PM (15 minutes)

Deep inelastic collisions were discovered few decades ago and are nowadays frequently used in well-chosen conditions for nuclear structure studies. However, those reactions are producing nuclei in a wide angular range due to an orbiting phenomenon which can occur during the interaction. We aim then to describe the mechanism evolution from a particular angle called "grazing angle" to zero degree. Moreover, we aim also to describe how exotic are the nuclei produced at zero degree.

To answer those questions data were collected during three experiments done at GANIL (Caen, France). We used several EXOGAM clovers for γ-rays detection and we used the LISE and VAMOS spectrometers for particles identification. The first experiment was covering a wide angular range from grazing angle to almost zero degree whereas the others focused at zero degree. During the talk, preliminary results of this analysis and some perspectives will be presented.

Author: Ms PORTAIL, Claire (IPN Orsay)

Presenter: Ms PORTAIL, Claire (IPN Orsay)

Session Classification: Nuclear physics

Track Classification: Nuclear Physics

Contribution ID: **4** Type: **Oral Presentation**

Development of new radioactive beams

Tuesday, May 10, 2016 3:15 PM (15 minutes)

A R&D program is developed at the ALTO facility (Accélérateur Linéaire et Tandem d'Orsay) at the Institute of Nuclear Physics of Orsay (IPNO) in order to provide new beams of exotic neutron-rich nuclei, as intense as possible. The production of such beams will allow performing crucial experience for the increase of our knowledge in the field of the nuclear physics. At ALTO, the neutron-rich nuclei are produced by photofission in thick actinide targets that are the subject of a R&D program. To improve the intensities of radioactive beams, in particular those formed by short-lived isotopes, two ways of research are explored. In the first one, the purpose is to develop dense and porous actinide targets, two properties a priori antagonistic but necessary to increase respectively the amount of fission fragments produced and their diffusion out of the target. In the second one, specific chemical processes are used to improve the release of refractory nuclei. In the framework of European projects, recent results have demonstrated the possibility to obtain beams of nuclei unreachable up to now using refractory targets with a nanoscaled structure. The improvement of such targets requires the control of the microstructure of the material prepared by reactive sintering and a systematic study of parameters such as temperature, pressure, sintering time and their effects on the stabilization of the obtained structure. In-beams experiments will establish the correlation between structural properties of the targets and the intensity of neutron-rich nuclei beams obtained by irradiating the target with ALTO. Various physicochemical phenomena are involved in the release process of neutron-rich nuclei produced in a thick target heated at high temperature (around 2000 ° C). A variety of chemical reactions (fluorination, sulfidation ...) can be exploited to improve the release of refractory nuclei. Thus, the latter work at ALTO showed efficient production of rare-earth molecular ion beams obtained with a fluorination process. This type of approach will be developed to produce other ion beams of refractory elements, such as iron or cobalt. Calculations and modeling would support the experimental method, in particular to optimize the microstructure of the target leading to the optimum intensities of fission products.

Authors: Dr ROUSSIÈRE, Brigitte (IPNO); Mr GUILLOT, Julien (IPNO); Dr TUSSEAU-NENEZ, Sandrine (Ecole Polytechnique)

Presenter: Mr GUILLOT, Julien (IPNO)

Session Classification: Nuclear physics

Track Classification: Nuclear Physics

Contribution ID: **5** Type: **Poster**

Complexation of plutonium, protactinium and trivalent actinides with organic ligands

Tuesday, May 10, 2016 10:15 AM (20 minutes)

The application of nuclear technology in industry, research and medicine leads to the production of radionuclides that are likely to cause environmental pollution or internal contamination (through inhalation, ingestion or wound) of nuclear workers and/or public. Indeed, contaminations are present in the surroundings of uranium mining sites, radwaste disposal facilities, or after accidental releases of radionuclides. The interaction of actinides with organic molecules, such as aminopolycarboxylic acids or hydroxypyridone derivatives, could trap the elements or inversely favor their migration. These phenomenons must be characterized in order to predict the behavior of actinides in the environment and in the human body. In this study, the chelating agents of interest possess hard donor atoms (oxygen and nitrogen) that bind strongly to f-element ions. These ligands may be present in the environment or they can be used as model of complex molecules, or considered as decorporation agents.
The aim of my thesis is the determination of thermodynamic and structural data of some complexes that Plutonium (Pu), Protactinium (Pa), Americium (Am), Curium (Cm) and Californium (Cf) can form with these organic molecules.
This poster reports the first data obtained for the complexation of Pa at the +5 oxidized state with NTA (nitrilotriacetic acid). The experiments have been performed with the isotope 233Pa at ultra–trace level.

Author: Ms LUCHINI, Coralie (IPN Orsay)

Co-authors: Mrs LE NAOUR, Claire (IPN Orsay); AUPIAIS, Jean (CEA)

Presenter: Ms LUCHINI, Coralie (IPN Orsay)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **6** Type: **Poster**

Deeply Virtual Compton Scattering at Jefferson Laboratory

Wednesday, May 11, 2016 2:30 PM (20 minutes)

The internal structure of the nucleon - that is, what ordinary matter is made of and what the laws describing it are at their most fundamental level - is still not fully understood by modern nuclear physics. Form factors provide insight about parton positions while parton distribution functions give information about their momentum distribution inside the nucleon, but no correlations can be established between parton positions and momenta at this level.

Introduced in the mid 90's, Generalized Parton Distributions (GPDs) provide a higher level of information since they correlate longitudinal momentum and transversal position of partons inside the nucleon. GPDs give a three-dimensional description of the internal structure of the nucleon. GPDs also give insights on the nucleon spin structure.

It has been established that GPDs are experimentally accessible through Deeply Virtual Compton Scattering (DVCS) and its interference with the Bethe-Heitler process. A worldwide experimental program was started in the early 2000's, and more specifically, a DVCS experiment studying the process ep -> epγ is currently ongoing at Jefferson Laboratory, Hall A (Virginia, USA).

The goal of my PhD is to take an active part in the data acquisition of this ongoing experiment, and then analyze these data in order to extract the DVCS helicity-dependent cross sections, as a function of the momentum transfer: Q^2. These cross sections will allow us to access the GPDs of interest and get insights on their dependence in Q^2, and thus, improve our understanding of the internal structure of the nucleon.

Author: Mr GEORGES, Frederic (IPN)

Presenter: Mr GEORGES, Frederic (IPN)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **10** Type: **Poster**

Analysis and development of deterministic and stochastic neutron noise computing techniques with applications to thermal and fast reactors.

Monday, May 9, 2016 3:30 PM (1 hour)

Traditional neutron noise analysis addresses the description of small time-dependent flux fluctuations induced by small global or local periodic perturbations of the macroscopic cross sections, which may occur in nuclear reactors due to stochastic density fluctuations of the coolant, to vibrations of fuel elements, control rods, or any other structures in the core. Neutron noise techniques are widely used by the nuclear industry for non-invasive general monitoring, control and detection of anomalies in nuclear power plants. They are also applied to the measurement of the properties of the coolant, such as speed and void fraction.

In power reactors, ex-core and in-core detectors can be used to monitor neutron noise with the aim of detecting possible anomalies and taking the necessary measures for continuous safe power production. Noise analysis relies upon the possibility of numerically simulating the behaviour of neutron noise and computing the changes in the neutron field produced by different representative sources of noise in reactor cores.

The general noise equations are obtained by assuming small perturbations around a steady state in the neutron field and by subsequently taking the Fourier transform in the frequency domain. The analysis is performed based on the neutron kinetic equations including the coupling with neutron precursors. The outcome of the Fourier transform analysis is a fixed-source equation for the perturbed neutron field, which can then be solved so as to predict noise measurements at detector locations. For each frequency, the neutron field is a complex function having an intensity and a phase.

The objective of this thesis is to develop techniques for neutron noise analysis and apply them to thermal and fast reactors. The implementation of these techniques was done using the new generation code APOLLO3®, developed at CEA, for deterministic transport and diffusion calculations. A new Monte Carlo algorithm that solves the transport equations for the neutron noise in the frequency domain has been developed. This new algorithm should be implemented in the reference Monte Carlo code TRIPOLI-4® developed at CEA. In addition, a one-dimension vibration model has been developed in order to simulate a periodic vibration of a fuel pin and to determine the neutron noise generated by this perturbation.

Author: Mrs ROUCHON, Amélie (Cea Saclay)

Presenter: Mrs ROUCHON, Amélie (Cea Saclay)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **11** Type: **Poster**

Search for heavy neutrinos with the T2K near-detector

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Neutrinos are the only matter particles in the Standard Model of particle physics that have only been observed with left handed chirality. If right handed neutrinos exist, they could be responsible for several phenomena that have no explanation within the Standard Model, including neutrino masses, the baryon asymmetry of the universe and dark matter.

The Neutrino Minimal Standard Model predicts the existence of three heavy neutrino, including two at GeV-scale. A particularly interesting mass domain is between 140 and 500 MeV, accessible to T2K, experiment initially built to study standard neutrino oscillations. The analysis aims at the study of heavy neutrino (N) produced in kaon decay along with the standard T2K neutrino beam, that decay in the near detector (ND280). The most promising channels are N->e pi, or N->mu pi. The excellent TPC performance will help in recontructing these decays.

This study requires a good understanding of the reconstruction algorithms which would allow to identify a heavy neutrino signal (peak in electron-pion or muon-pion invariant mass distribution). An important step is to understand background coming from standard neutrino interactions. The final goal is to place limits on unknown heavy mixing parameters and compare them with other bounds.

Author: Mr LAMOUREUX, Mathieu (CEA Saclay, IRFU)

Presenter: Mr LAMOUREUX, Mathieu (CEA Saclay, IRFU)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **12** Type: **Oral Presentation**

Optimization analysis of Pressurized Water Reactors in the framework of the introduction of renewable energies in the french energy mix.

Monday, May 9, 2016 5:45 PM (15 minutes)

In the actual context of energetic transition, the increase of the renewable energies contribution (as wind farms, solar energy, or biomass) is a major issue. For example, the part of intermittent renewable energies is forecast to be around 30% of the total production in 2030, against 6% today. On the other hand, their intermittent production may lead to an important imbalance between production and consumption. Indeed, the peak production may reach 3 or 4 times the average production if the conditions are satisfactory but the production can drop to 0 at worst. Consequently, the others ways of production must adapt to those variations, especially nuclear energy which is the most important in France. Nuclear power plants which take part in the response of the power variations, operate in the so-called load following mode. This work is included in the study of the effects on the nuclear power plants of a large introduction of renewable intermittent energies : how to optimize the power plants toward a larger manageability, meeting the safety constraints. The pressurized water reactors (PWR) 1300MW operated in the "G"mode are selected as they are the most likely to perform the load-following among the french nuclear fleet. In a first step, a multi-physics PWR model will be designed using the control parameters such as the control rods or the soluble boron, and the main values of interest of the reactor will be computed. In a second step, the management will be improved using a multiobjective optimization approach which minimizes the different values of interest.

Author: Mr MUNIGLIA, Mathieu (CEA)

Co-authors: Mr GRARD, Hubert (CEA); Dr LE PALLEC, Jean-Charles (CEA); Mr DO, Jean-Michel (CEA); Dr DAVID, Sylvain (IPN); Dr VEREL, Sébastien (LISIC)

Presenter: Mr MUNIGLIA, Mathieu (CEA)

Session Classification: Nuclear reactors and medical physics

Track Classification: Nuclear Physics

Contribution ID: **13** Type: **Poster**

Radiation effect on an ion-irradiated under-saturated Fe1at.%Mn alloy.

Wednesday, May 11, 2016 2:30 PM (20 minutes)

Reactor pressure vessel (RPV) steels embrittlement under neutron irradiation is the main lifetime limiting factor of nuclear reactors. The RPV embrittlement is primary due to the impeding of dislocation glide caused by their interaction with nanometric clusters composed of point defects and/or solute atoms which form under irradiation. Point defect clustering can lead to the formation of crystallographic defects such as dislocation loops or voids.
In this study, the effect of Mn in an under-saturated ferritic Fe1at.%Mn model alloy was experimentally investigated at the atomic scale by Transmission Electron Microscopy (TEM) and Atom Probe Tomography (APT) on ion-irradiated samples. The irradiation with 10 MeV Fe5+ ions was performed at 400℃ at a nominal damage rate of 10-4 dpa.s-1 to a nominal displacement damage of 2.5 dpa.
The detailed analysis shows that the microstructure totally depends on the composition. In pure Fe, an homogeneous distribution and a significant number density of both dislocation loops and voids were revealed. However, in Fe1at.%Mn, a high number density of dislocation loops was observed, in opposition to voids. Radiation-Induced Segregation (RIS) of Mn was recorded by STEM/EDX in the vicinity of dislocation loops and grain boundaries, according to observations made on dislocation lines. An additional analysis realized by APT supported these observations by showing Mn depletion within the matrix. The results obtained indicate that Mn would significantly contribute to swelling reduction. Diffusion mechanisms of solute atoms leading to the preferential formation of dislocation loops or voids are still not well understood under irradiation.
To go further, we plan to carry out in-situ irradiation of Fe1at.%Mn samples using charged particles such as ions. Setting imaging and irradiation conditions using ions would enable us to better understand how irradiation defects form while taking into account the cascade effect.

Author: Ms BELKACEMI, Lisa (CEA Saclay)

Presenter: Ms BELKACEMI, Lisa (CEA Saclay)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **14** Type: **Poster**

Investigation of shell evolution in the vicinity of 78Ni by beta-decay spectroscopy

Wednesday, May 11, 2016 2:30 PM (20 minutes)

The objective of my thesis is to study the one particle orbitals when getting closer to the 78Ni. Are the N=50 and Z=28 gaps stay big enough to ensure the magicity of 78Ni?

Concretely, it's about studying nuclei in the isotonic chains N=49 and N=51, 79,81Zn fed by beta and beta-n decay of 79,81Cu and 80Cu. The low energy states in daughter nuclei will help to reconstruct the 1 particle / 1 hole neutron state positions and to study the evolution toward to 78Ni.

How to strudy these nuclei? The experiment I'm analysing in my thesis has been done in 2012 at RIKEN, Tokyo, during the EURICA campaign. The objective of this campaign was to establish the low energy spectrum of the nuclei around the 78Ni, so in the N=50 and Z=28 region. The setup included 12 EURICA clusters for gamma detection and a stack of 8 DSSSD detectors composing WASABI used for particle detection.

Author: Mrs DELATTRE, Marie-Coralie (IPNO)

Presenter: Mrs DELATTRE, Marie-Coralie (IPNO)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **15** Type: **Oral Presentation**

High-Efficiency 12GHz Klystron Design for CLIC Project

Wednesday, May 11, 2016 9:00 AM (15 minutes)

The CLIC project (Compact LInear Collider) requires the conditioning of 120000 cavities with high-power 12GHz-klystrons. My PhD project is the design of such a high-efficiency klystron. I work firstly at the enhancement of a Thales 4.9GHz-klystron to increase its efficiency.

A klystron is a linear-beam vacuum tube that amplify or generate a RF signal. An electron stream is created with a gun and confined by an external magnetic field. The beam modulation is triggered by the RF signal in the input cavity ; the electrons velocities along the drift tube change with the phase of the signal. The beam is then modulated into a set of electron bunches by the gain cavities. The electrons release their kinetic energy in the form of a RF signal at the output cavity. The electrons are finally absorbed in the collector.

In order to validate experimentally our high-efficiency klystron (or "Kladistron") concept, we are working at the enhancement of the electrons bunching. With more cavities than in a standard klystron, we can obtain a smoother beam current growth and a better bunching. We currently focuse on the Thales TH2166 klystron by changing its interaction line of 6 cavities; our simulations lead us to a 16 cavities design. We keep the other elements of the TH2166 klystron: the electron gun, the solenoid, the collector, the input and output cavities.

We finished the cavities design and the blue prints of the prototype cavities; we will start the test in May 2016. We will test our first Kladistron at Thales Velizy by the end of 2016; these preliminary results will help us in the 12GHz Kladistron design. We are also studying instabilities phenomenons, bunching enhancement and multipactor.

Author: MOLLARD, Antoine (CEA)

Presenter: MOLLARD, Antoine (CEA)

Session Classification: Accelerator physics

Track Classification: Accelerator Physics

Contribution ID: **16** Type: **Oral Presentation**

Study of a Direct Conversion of Wind Energy into Electricity

Wednesday, May 11, 2016 4:00 PM (15 minutes)

The increasing global demand for energy and the consideration of environmental constraints have rekindled the interest for various forms of renewable energy production modes, including wind energy. In addition to the traditional wind turbines, the new idea is to convert wind energy directly into electrical energy without any moving parts.

The principle of direct conversion is actually quite simple as the wind moves the charged particles at atmospheric pressure against the direction of an electric field, thus increasing the electric potential energy of the charged particles. Then, all these charged particles can be collected by a metallic structure whose potential will rise when particles touch it. That's why we can call this process a direct conversion of wind energy into electrical energy as there is no more mechanical movement involved.

Even if experimental results have shown some positive yields, the output power is still very low. The most difficult problem in designing a bladefree wind power system is the production of aerosols having the suitable properties, while using input energy clearly lower than the recoverable power.

We aim at understanding better the physics of particle generation and gas interaction including ion emission, fission, evaporation in flight and ion-neutral collisions in the air flow. Currently we are designing a prototype with only one injector at a small scale. If the results are successful, the future would be to multiply the injectors in order to make up for the poor charge production. Characterization methods of the electrospray will also be discussed. Moreover, research on aerosol will also lead to completely different purposes like electrostatic sprays at atmospheric pressure for mass spectrometry.

Author: Mrs VERZEROLI, Elodie (Doctorant)

Co-authors: Dr RASSER, Bernard (Orsay Group); Dr DELLA NEGRA, Serge (IPNO)

Presenter: Mrs VERZEROLI, Elodie (Doctorant)

Session Classification: Particle transport and applications

Track Classification: Particle Physics

Contribution ID: **17** Type: **Poster**

Study of neutron-proton pairing with transfer reactions.

Monday, May 9, 2016 3:30 PM (1 hour)

In the present work, the study of transfer reactions in ⁵⁶ Ni is presented. The study is focusing in the neutron-proton pairing, which is a local interaction inside the nucleus. In addition with the mean field potential in the nucleus pairing induces correlations. There are two channels for pairing, one with isospin T=1 (isovector) and the other with isospin T=0 (isoscalar), in which pairing is expected to be stronger. One of the studied transfer reactions is the (d,α), which it only highly populates bound states with T=0 due to the isospin conservation.

The experiment was performed in GANIL,Caen in spring of 2014. The aim is to measure the energy and angle of the α particles emitted from the (d,α) reaction in forward direction. For this purpose a high granularity Silicon stripped detector was placed in this direction, which is called MUST2. For the time calibration purposes a time calibrator module has been used. The first results concern the Time of Flight (ToF) analysis, which is used for mass identification.

Author: Ms GEORGIADOU, Anastasia (IPN)

Presenter: Ms GEORGIADOU, Anastasia (IPN)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **18** Type: **Poster**

Microscopic description of collective excitations in atomic nuclei within the GCM framework

Wednesday, May 11, 2016 2:30 PM (20 minutes)

The relativistic mean-field models, based on the energy density functionals theory and extended to include pairing correlations, provide a very good microscopic description of ground-state properties of atomic nuclei. However, in order to calculate excitation spectra and electromagnetic transition rates, it is necessary to take into account collective correlations that arise from symmetry restoration and fluctuations around the mean-field minima. The method of choice for this kind of calculation is the generator coordinate method (GCM), which enables us to calculate the collective spectra, wave functions, as well as expectation values of various observables that can in principle be compared to the experiment. In our calculations, relativistic Hartree-Bogoliubov model on a mean-field level is supplemented by the generator coordinate method with quadrupole and octupole deformations as generating coordinates in a beyond mean-field study of nuclear structure phenomena. Particularly, the questions of octupole correlations, which drive nuclei towards deformed pear-like shapes, and cluster formation, which can be considered as a transitional phase between the quantum liquid and crystal phases, will be addressed.

Author: Mr MAREVIC, Petar (CEA, IPN)

Presenter: Mr MAREVIC, Petar (CEA, IPN)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **19** Type: **Poster**

Study of neutron monopole drift towards ^{78}Ni with AGATA at GANIL and BEDO at ALTO

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Recent experimental discoveries have revealed that the neutron effective single particle evolution above ^{78}Ni shows peculiar and unpredicted behaviours. Our study us mainly focussed on the neutron $g_{7/2}$ effective single particle energy (ESPE) evolution towards ^{78}Ni. This evolution should be driven by the same tensor mechanism which produces a quasi-degeneracy of the $d_{5/2}$-$g_{7/2}$ orbits in the ^{100}Sn region. The light odd-neutron N=51 nuclei constitute the most interesting cases in order to study this evolution and constrain theoretical models. We have performed two complementary experiments to populate $\frac{7}{2}^+$ states in ^{83}Ge, one in flight experiment at GANIL, using the fusion-fission Be+^{238}U reaction to populate Yrast states, one ISOL experiment at ALTO using the decay of ^{83}Ga to populate non-Yrast states. The experiment at GANIL was made with AGATA, VAMOS and a plunger which permit to distinguish single particle (long lived) or collective (short lived) origin of potential $\frac{7}{2}^+$ state. The experiment at ALTO used the Compton suppressed gamma spectrometer BEDO including 2 tapered and 2 clovers of HPGe. In this poster, the physics motivation, the experimental arrangements and preliminary results will be presented.

Author: Mr DELAFOSSE, Clément (IPNO)

Presenter: Mr DELAFOSSE, Clément (IPNO)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **20** Type: **Poster**

Modelling QSO infall velocity distribution using N-body simulations for eBOSS RSD analysis

Tuesday, May 10, 2016 10:15 AM (20 minutes)

The eBOSS multi-object spectrograph has undertaken a survey of Quasars (QSO) in the redshift range $0.9 < z < 2.2$. It will measure the growth rate of structures from the Redshift Space Distortions (RSD) of the 2-point correlation function and allow for a test of general relativity modifications and dark energy scenarios.
To perform this measurement, special care should be given to the RSD model. The most popular model is the Gaussian Streaming model which convolutes a Gaussian probability distribution for infall velocities with the real space correlation function.
In this poster, we will present one of the most recent RSD model based on Convolution Lagrangian Perturbation Theory and its applicability for the QSO tracer. Moreover, using N-body simulations, the Halo occupancy distribution of QSO in dark matter halos can be investigated and we will examine at which scale this model is valid in the redshift range of eBOSS. Furthermore, the pairwise velocity distribution displays exponential tails at odds with the Gaussian streaming model. We will present an attempt to parametrize the full infall velocity distribution from N-body simulations. Then using a specific streaming model, we plan to quantify the difference with the Gaussian Streaming Model.

Authors: BURTIN, Etienne (CEA-Saclay Irfu/SPP); Ms ZARROUK, Pauline (CEA-Saclay)

Presenter: Ms ZARROUK, Pauline (CEA-Saclay)

Session Classification: Poster session

Track Classification: Cosmology & Astroparticles

Contribution ID: **21** Type: **Oral Presentation**

Quasar-Lyman α Forest Cross-Correlation from SDSS-III BOSS survey: Baryon Acoustic Oscillations

Tuesday, May 10, 2016 4:00 PM (15 minutes)

We measure the large-scale cross-correlation of quasars with the Lyman-alpha forest absorption field. We use over 170,000 forests from Data Release 12 (DR12) of the SDSS-III BOSS survey and over 240,000 quasars from DR12 and from DR7 of the SDSS-II survey. This study allows us to measure the Baryonic Acoustic Oscillation (BAO) scale, along and across the line of sight, at a mean redshift of z = 2.40. These scales are linked to the Hubble parameter and the angular diameter distance, respectively. We produced a set of 100 Gaussian random field simulations. The covariance of the set is found to agree with the covariance matrix calculated from the data. We use these simulations to search for a possible bias in the measurement of the BAO scale.

Author: Mr DU MAS DES BOURBOUX, Hélion (CEA, Saclay)

Presenter: Mr DU MAS DES BOURBOUX, Hélion (CEA, Saclay)

Session Classification: Cosmology and astroparticles

Track Classification: Cosmology & Astroparticles

Contribution ID: **22** Type: **Poster**

Analyzing the ion radiation-induced defects and cavity swelling evolution in representative PWR internal austenitic steels

Wednesday, May 11, 2016 2:30 PM (20 minutes)

The French nuclear industry is looking into the extension of the operation time of pressurized water reactors (PWR) up to 60 years. The nuclear reaction occurs in a vessel which contains the core internals supporting the fuel assemblies. The lower parts of the internals are composed of Solution Annealed 304 austenitic stainless steel plates and Cold Worked 316 stainless steel bolts. Due to their high exposition to irradiation it is expected to reach doses as high as 120 dpa after 60 years, at a temperature ranging from 300 to 370℃.
Irradiation leads to microstructural and microchemical changes such as formation of black dots, dislocation loops and lines, cavities(voids and/or bubbles), segregation and precipitation. These may result in evolutions of the macroscopic behavior (swelling, irradiation creep, hardening, and corrosion resistance).
Swelling is a macroscopic dimensional modification. In Fast Breeder Reactors, it has been associated to the formation and growth of cavities. Cavities have been observed in PWR irradiated materials on several occasions, and with the aim of an extension of their operation time, the evolution of the microstructure at high doses is a matter of concern.

Heavy ion irradiations enable to reach high doses in little time and to avoid drawbacks of neutron irradiations such as activation. Such experiments are performed to simulate PWR microstructural evolutions under neutron irradiations. Two SA 304 steels containing different amounts of carbon are investigated.

Ion irradiations from 5 dpa to 100 dpa have been carried out at JANNuS-Saclay using iron ions (10 MeV). To counterbalance the flux effect, which is 2-3 orders of magnitude higher than PWR, irradiation temperature was set to 450℃. Radiation-induced microstructures are investigated by Transmission Electron Microscopy (TEM). The evolution of radiation-induced defects as cavities, Frank loops and precipitates with the dose are studied as well as the influence of carbon.

Author: Mr MICHAUT, Bertrand (CEA)

Presenter: Mr MICHAUT, Bertrand (CEA)

Session Classification: Poster session

Track Classification: Accelerator Physics

Contribution ID: **23** Type: **Oral Presentation**

Nuclear Mass Measurements and Evaluation

Tuesday, May 10, 2016 3:00 PM (15 minutes)

Nuclear Masses are widely used in nuclear physics, astrophysics and in advanced applications such as nuclear energy and waste management. However only about 2800 of the nuclear masses have been experimentally determined for the moment, while 6000-7000 nuclei have been estimated to exist in the Chart of Nuclides. In nuclear astrophysics, the nuclear mass is an important input for nucleosynthesis network calculation, which yields the final element abundances and energy generation rates. There are several techniques that allow high precision mass measurements, but the most precise are those carried out using modern Penning Traps, where resolutions of 107 and precisions better than 10-10 have been obtained. Other modern methods include storage rings like those at GSI and at IMP-Lanzhou, or multi-reflection time-of-flight technique at Cern and at Riken.

The Atomic Mass Evaluation (AME) is the most reliable source for comprehensive information related to the atomic masses. It provides the best values for the atomic masses and their associated uncertainties by evaluating all available experimental data from radioactive decays, nuclear reactions and direct mass measurements using a weighted, least-squares approach. The particularity of the AME is that any mass measurement basically establishes a relation between two or more nuclides, and given that a single nuclide can enter measurements using different techniques, this leads to a network of connections amongst nuclides.

In this presentation, different techniques for nuclear mass measurements will be illustrated and the philosophy of AME will be introduced.

Author: Mr HUANG, Wenjia (CSNSM (IN2P3-CNRS & UPS))

Presenter: Mr HUANG, Wenjia (CSNSM (IN2P3-CNRS & UPS))

Session Classification: Nuclear physics

Track Classification: Nuclear Physics

Contribution ID: **24** Type: **Poster**

study of prompt gamma emission in the fission mechanism

Monday, May 9, 2016 3:30 PM (1 hour)

Presented here is my work on the study of prompt gamma emission in the fission mechanism. From a nuclear reactor physics point of view, it addresses the gamma heating issue in nuclear reactor cores. On the other hand, gamma emission can help understand the fission process in terms of fundamental physics. Results from experiments in 2016 at ALTO(Linear Accelerator and Tandem Orsay) by using the LICORNE neutron source, to study prompt fission gamma rays of U-238 at neutron energies of 1.7MeV and 4.5MeV. LICORNE can generate natural focusing of fast neutrons by inverse kinematics reaction: p(7Li, n)7Be and p(11B,n)11C. This feature allows the placement of detectors close to the target with low neutron background from the source. In this experiment, several types of scintillator were used to detect gamma rays, including LaBr3, BaF2 and a new type of phoswich named PARIS. The measured spectra will be deconvoluted by using response matrices simulated in GEANT4.

Author: Mr QI, Liqiang (IPN NESTER)

Presenter: Mr QI, Liqiang (IPN NESTER)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **25** Type: **Poster**

Measurement by gamma ray spectrometry in gamma-gamma coincidence.

Tuesday, May 10, 2016 10:15 AM (20 minutes)

The laboratory of environmental radioactivity measurement performs around 2000 measurements per year by low level gamma ray spectrometry, either in the framework of the environmental surveillance in France handled by the IRSN, or for research or expertise purpose in the radioecology domain. In both cases the anthropogenic radioactivity in environment samples is measured at trace levels and metrology developments are continuously necessary in order to deal with these very low levels.
The latest development is the gamma-gamma coincidence measurement based on the use of two germanium detectors to detect one photon in each detector.
This method was firstly implemented on an anti-Compton system, consisting of a germanium (HPGe) detector surrounded by two sodium iodide scintillators (NaI(Tl)): an annulus and a plug to cover around 4□□□□The digital acquisition electronics provides a list mode file with energy and time stamp information for each detected event. An algorithm was developed to plot spectra (classic, in coincidence or in anti-coincidence) or the coincidence matrix (energy loss in the NaI detector versus energy loss in the HPGe). The algorithm searches and counts the coincidence events of interest in the matrix around their theoretical location and the corresponding activity is determined by way of a calibration factor. It was obtained by the experimental measurement of standard sources containing for instance 60Co or 88Y and by Monte Carlo simulations using MCNP_CP (Berlizov,2013). Both calibration coefficients are perfectly in agreement and the method can be extended to all radionuclides: 134Cs, 152Eu, 108mAg⋯
This analysis method was therefore used on a new versatile system developed and optimized in terms of efficiency, low background and compactness: it consists of two HPGe detectors face to face surrounded by a NaI(Tl) scintillator. The whole system is surrounded by a 5 cm lead shield. This new system is installed in a 20 m² shielded room (10 cm lead, 5 mm copper) located in the second basement of the laboratory under a slab of 3 meters of borated concrete.
Thanks to the analysis code of the list mode file, a measurement can be analysed at once in the following different ways:
1. Classic Ge spectrum for each Ge detector.
2. Summation of spectra of both detectors. The efficiency increase leads to decrease uncertainties and detection limits and counting time for single emitters.
3. Anti-cosmic spectrum.
The cosmic ray induced background decrease leads to a better determination of 137Cs in aerosol filters for instance.
4. Anti-Compton spectrum.
The Compton continuum decrease leads to a better determination of single emitters (with energy lower than 1460 keV) in biological matrices containing much 40K.
5. Coincidence Ge-Ge matrix of Ge spectrum in coincidence.
This is the most powerful tool for all the coincident emitters due to a drastically decreased background. Moreover some radionuclides have many coincident emissions and all the data can be accumulated (for instance, 108mAg has 6 usable coincidences) to make the determination more accurate.
The gamma-gamma coincidence techniques used on the anti-Compton system divides detection limits by a factor of 10 (It shows also that the calibration can be done by MCNP_CP simulations). First results on the new Ge-Ge-NaI system show dramatically reduced noise in matrices and spectra and all the possibilities with only one measurement.

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Berlizov.A, (2013) MCNP_CP, A correlated Particle Radiation Source Extension of a General Pur-

pose Monte Carlo N-Particle Transport Code.

Author: Mr PARADIS, hugues (IRSN)

Co-authors: Mrs DE VISMES OTT, Anne (IRSN); Mr PIQUEMAL, Fabrice (CENBG); Mr GURRIARAN, Rodolfo (IRSN); Mr CAGNAT, Xavier (IRSN)

Presenter: Mr PARADIS, hugues (IRSN)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **26** Type: **Oral Presentation**

Adaptive Multilevel Splitting for Monte Carlo particle transport

Wednesday, May 11, 2016 4:15 PM (15 minutes)

In the Monte Carlo simulation of for particle transport, and especially for shielding applications, variance reduction techniques are widely used to help simulate realisations of rare events, and reduce the relative errors on the estimated scores for a given computation time. Adaptive Multilevel Splitting (or AMS) is one of these variance reduction techniques that has recently appeared in the literature. For the time being, it has only been applied to the field of molecular dynamics. The purpose of my thesis is to try and apply this method to Monte Carlo particle transport. The original algorithm has been adapted to the frame of particle transport, and implemented into the Monte Carlo transport code TRIPOLI-4 ®, developed by the Service d'Étude des Réacteurs et de Mathématiques Appliquées (SERMA) at CEA Saclay. I will show that the preliminary results are promising.

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Presenter: Mr LOUVIN, Henri (CEA)

Session Classification: Particle transport and applications

Track Classification: Particle Physics

Contribution ID: **27** Type: **Poster**

3D Indoor / Real-time Topographical and Radiological Mapping (ITRM), with Visual Simultaneous Localization And Mapping (SLAM): methods and uncertainties estimations.

Wednesday, May 11, 2016 2:30 PM (20 minutes)

New developments in the field of robotics and computer vision enables to merge sensors to allow fast real-time localization of radiological measurements in the space/volume with near-real time radioactive sources identification and characterization, especially when premises statements are unknown. These capabilities lead nuclear investigations to a more efficient way for operators' dosimetry evaluation, intervention scenarii and risks mitigation and simulations, such as accidents in unknown potentially contaminated areas or during dismantling operations.

The main aim of the device we developed is to build a 3D model containing the device pose estimations in volume, in real time with a RGB-D sensor using "Simultaneous Localization And Mapping" methods.

This Poster will present a new way for radiological and topographic mapping of the environment by merging out coming data from RGB-D sensors, dose rate meters and spectrometers on a mobile handheld device. Two phases are considered while using this instrument. The first step concerns data acquisitions merged and processed in real-time and the second step concerns post processing used for advanced surveys (e.g. 3D reconstruction point cloud processing, radioactivity source terms accurate localization and calculations, dismantling scenarii).

In order to quantify the processing hardware and sensors performances, to evaluate the process chain and results accuracies, the current R&D program is progressing towards measurement's errors evaluation and uncertainties propagation along the acquisition and process chain. The main aim is to give objective criteria concerning the quality of the used methods at each step of the acquisition and post-processing, such as macroscopic sensitivity study. Secondly, this uncertainty study will provide objective accurate data about the acquisition processing, 3D reconstruction, trajectory computation and measurements and intensities. Furthermore, it could provide feedbacks on employed methods for investigations or intervention processes. The objective is to implement uncertainty propagation, computed in real-time for each acquisition and providing a reliable index value.

Author: Mr HAUTOT, Félix (CSNSM (CNRS))

Co-authors: Mr CHAGNEAU, Benjamin (Areva D&S); Dr BACRI, Charles-Olivier (CSNSM (CNRS)); Mr DUBART, Philippe (Areva D&S)

Presenter: Mr HAUTOT, Félix (CSNSM (CNRS))

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **30** Type: **Poster**

Study of fission of exotic actinides by relativistic reactions

Monday, May 9, 2016 3:30 PM (1 hour)

A precise description of fission is essential for reactor safety, to assess the feasibility of waste transmutation and for the design of a next generation of reactors. However, despite a long history of work, the theoretical description of nuclear fission - one of the most complex processes on the nuclear scale - is still far from complete. In addition, information of fission of exotic actinides is rather limited since they are not accessible in standard experiments.

Fission fragments have significant impacts on reactors: they are the source of delayed neutrons; they are responsible for the poisoning of the core; and they are dominant source of residual decay heat. Besides, isotopic yields (mass and nuclear charge) of fission fragments are crucial inputs for simulation codes and would largely constrain the fission modeling. Nevertheless, no precise data on the isotopic yields is available since it is very difficult to identify the nuclear charge with good resolution.

SOFIA (Study On Fission in Inverse kinematics with Aladin) is an international collaboration program aiming at simultaneously measuring the mass and nuclear charge yields of both fission fragments over a range of fissioning nuclei. Inverse kinematics is used: the relativistic fissioning system (for example 238U) is the beam, and in-flight fission leads to high-velocity, forward-focused fission fragments which can then be identified in a recoil spectrometer. Also, fission of neutron-deficient actinides and pre-actinides can be studied by fragmenting a 238U beam and selecting fragments to form a secondary beam. Fission is induced by electromagnetic interaction rather than collision to let the excitation energy of the nuclei comparable to that in the fission triggered by neutron capture in reactors, thus making experimental data relevant to applications.

The nuclear charge is directly determined by the energy loss measured in an ionization chamber. Then the mass is deduced from measured time of flight, the magnetic rigidity and the nuclear charge.

Last SOFIA experiment was conducted in October 2014 in GSI in Germany. Fission fragment distributions of 236U, compound nuclei formed when a neutron is captured by 235U, were measured.

In the poster, I will present the identification map of the secondary beam and the elemental yield of fission fragments of 236U.

Author: Ms YAN, Yiman (IPN Orsay)

Presenter: Ms YAN, Yiman (IPN Orsay)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **31** Type: **Oral Presentation**

Phenomenological study of exclusive binary light particle production from antiproton-proton annihilation at FAIR/PANDA

Wednesday, May 11, 2016 11:00 AM (15 minutes)

Exclusive binary annihilation reactions induced by antiprotons of momentum from 1.5 to 15 GeV/c can be extensively investigated at FAIR/PANDA [1]. We are especially interested in the channel of charged pion pairs. Whereas this very probable channel constitutes the major background for other processes of interest in the PANDA experiment, it carries unique physical information on the quark content of proton, allowing to test different models (quark counting rules, statistical models,..). To study the binary reactions of light meson formation, we are developing an effective Lagrangian model based on Feynman diagrams which takes into account the virtuality of the exchanged particles. Regge factors [2] and form factors are introduced with parameters which may be adjusted on the existing data. We present reproduce results of our formalism of different reactions of light meson production for reliable predictions of cross sections, energy and angular dependencies in the PANDA kinematical range.

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Presenter: Ms WANG, ying (Institut de Physique Nucléaire Orsay)

Session Classification: Hadronic physics

Track Classification: Nuclear Physics

Contribution ID: **32** Type: **Poster**

Improvement robustness up to 400℃ of the passivation of c-Si wafers by p-type a-Si:H thanks to ion bombardment

Tuesday, May 10, 2016 10:15 AM (20 minutes)

a-Si:H/c-Si heterojunction solar cells have reached record efficiencies of 24.7% (22% in industry) [1]. The passivation of c-Si in silicon heterojunction solar cells is the key to achieve a high-efficiency. The abrupt discontinuity in the crystal structure at the amorphous/crystal interface induces a high density of dangling bonds, thus creating a large density of defects induced energy levels in the bandgap. This defects are recombination center for the electron-hole pairs generated in c-Si during the illumination. Several dielectric layers can be used to passivate n-type and p-type wafers, such as thermally grown SiO2, PECVD a-SiNx:H, Al2O3 or a-Si:H. The most versatile passivation layer is a-Si:H [2], it is effective both for p-type and n-type wafers. In addition, this process has a low thermal budget since the deposition is made below 200℃. The drawback of this passivation layer, in particular when p-doped, does not withstand temperatures above 200℃ [3]. However, in order to have a good electrical contact, a TCO layer with good optical and electrical quality as well as metal electrodes with good ohmic contact, annealing at temperatures up to 500℃ is desirable [4]. We homogeneously implanted argon ions, with IRMA implanter, solar cell precursors synthetized at LPICM. We irradiated samples with energies between 5 and 30 keV, to control the depth at which we are creating defects. By varying the fluence between 1012 Ar.cm-2 and 1015 Ar.cm-2 we control the concentration of defects created. We show that irradiation with an energy of 5 keV with a fluence of 1015 Ar.cm-2 does not degrade significantly the solar cell precursor. The effective lifetime of the minority carriers measured using a Sinton Consulting (WT-120) from 2.6 ms to 2.4 ms after irradiation. On the other hand an energy of 10 keV with a fluence of 1014 Ar.cm-2 or an energy of 17 keV with a fluence of 1012 Ar.cm-2 is sufficient to degrade the lifetime of more than 85% [5]. Following the irradiations, the solar cells have been annealing in a controlled atmosphere at different temperatures. We show that annealing heal the defects introduced by irradiation. Moreover, lifetime after irradiation and annealing above the as-deposited lifetime can be obtained. Finally, we show that ion irradiation allows to maintain a good lifetime above 1 ms after annealing our solar cell precursors up to 380℃.

(These results are part of a patent deposited September 7, 2015).

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Author: Ms DEFRESNE, Alice (CSNSM)

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Presenter: Ms DEFRESNE, Alice (CSNSM)

Session Classification: Poster session

Track Classification: Accelerator Physics

Contribution ID: **33** Type: **Oral Presentation**

Warm Dark Matter Constraints using the Lyman-alpha Forest

Tuesday, May 10, 2016 4:30 PM (15 minutes)

Lyman-alpha absorption features probe the distribution of neutral Hydrogen (a legitimate tracer for dark matter) along the line-of-sight of luminous, high-redshift quasars. As such, they are a useful tool for probing the power spectrum at scales below a few Mpc and can thus be a powerful data set to test non-linear cosmological effects such as the mass of neutrinos.

Using an unprecedently large sample of ˜14,000 BOSS quasars from the SDSS DR9, the most stringent constraints to date on the mass of warm dark matter particles and the sum mass of neutrinos were obtained using the Lyman-alpha flux power spectrum. I will centre this talk around the impact of kilo-electronvoltaic dark matter particles on cosmology, and how the Lyman-alpha flux power spectrum was constructed and used to establish mass constraints for thermally produced particles and non-resonantly produced sterile neutrinos.

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Presenter: Mr BAUR, Julien (CEA-Irfu/SPP)

Session Classification: Cosmology and astroparticles

Track Classification: Cosmology & Astroparticles

Contribution ID: **34** Type: **Poster**

Searching for neutrinoless double beta decay with scintillating bolometers: the LUCINEU experiment

Wednesday, May 11, 2016 2:30 PM (20 minutes)

nbsp; nbsp; nbsp; nbsp; Neutrinoless double beta decay is a very rare nuclear process whose observation would provide essential information on neutrino properties. My PhD thesis subject focuses on the search for this phenomenon in the isotope ¹⁰⁰Mo. The thesis activity aims at preparing and performing an underground demonstrator experiment named LUCINEU.

 nbsp; nbsp; nbsp; nbsp; This experiment uses as detectors scintillating bolometers. They are made of scintillating crystals of ZnMoO₄ and Li₂MoO₄ (including enriched ¹⁰⁰Mo) produced in NIIC (Novosibirsk), NTD Ge thermistors previously characterized in their resistivity- temperature and voltage-current behavior, NTD Ge and light detectors working in the range 10-20 mK.

nbsp; nbsp; nbsp; nbsp;Some RD tests are ongoing at the Underground Laboratory of Modane. In this poster, I will present first results coming from a big enriched Li₂MoO₄ crystal and a detector decoupling system obtained in the EDELWEISS set-up with the aim to get better noise conditions. This configuration is a possible prototype for a suspension system for the LUCINEU project.

 nbsp; nbsp; nbsp; nbsp; Looking at these results, it is clear that Li₂MoO₄ crystals are very promising candidates for double beta decay researches.

Author: Ms ZOLOTAROVA, Anastasiia (CEA/IRFU/SPP)

Presenter: Ms ZOLOTAROVA, Anastasiia (CEA/IRFU/SPP)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **35** Type: **Oral Presentation**

Investigation of the formation mechanisms of the High Burnup Structure in the spent nuclear fuel – Experimental simulation by in situ Transmission Electron Microscopy experiment with ion beams

Monday, May 9, 2016 5:30 PM (15 minutes)

This Ph.D. study is concerned with the UO2 nuclear spent fuel. A high burnup structure (HBS, also so-called rim structure) is observed with a typical thickness of 100 to 200 µm at the peripheral region of the nuclear fuel pellets. Several observations and characterizations are notable in that zone [1-5]:

1- An increase of Pu content and burnup.

2- The development of fission gas pores (leading to a porous region) with a typical diameter 1-2 µm and the maximum porosity between 10% and 22%.

3- A large reduction in crystallite size, where the original grain, having a typical size of around 10 µm, subdivides into sub-micron grains with a size of about 0.2 to 0.3 µm.

4- A decrease in the content of Xenon fission product within the UO2 grains (athermal release of Xe from the UO2 grains).

The main objective of this study is to understand the mechanisms of formation of this high burnup structure, using experimental simulation with ion beams.
The Transmission Electron Microscopy (TEM) technique is one of the characterization methods that can be applied to observe the HBS structure and to identify the mechanisms which are responsible to the appearance of such structure. Ion beams are a very convenient tool to experimentally simulate both the damage induced by neutron irradiation in a nuclear reactor, and the presence of foreign species, like fission products produced by nuclear reactions.

Therefore, in situ TEM experiment was performed at JANNuS-Orsay facility [6] to reproduce and observe directly the specific microstructure evolution of the irradiated nuclear fuel. This is experimentally simulated by using a very simplified model system –namely uranium dioxide single crystals –and 260 keV Xe ion beam at 500°C for generating radiation damage and doping the material with xenon fission product. The results show the importance of the various relevant parameters involved in the formation of high burnup structure, and help in clarifying the synergies between them.
The results will compared to RBS/C (Rutherford Backscattering Spectrometry in channeling geometry) experiments in the near future.

References:

[1] Vincenoz V.Rondinella and Thierry Wiss, The high burnup structure in nuclear fuel. Materials Today, 13 (2010)12.

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[5] K. Nogita , K. Une , M. Hirai , K. Ito , K. Ito , y. Shirai , Effect of grain size on recrystallization in high burnup fuel pellets, Journal of Nuclear Materials 248 (1997) 196-203.

[6] The JANNuS-Orsay facility consists of a Transmission Electron Microscope coupled to two ion accelerators, IRMA and ARAMIS. See http://www.csnsm.in2p3.fr/Equipements for more details.

Author: Ms HADDAD, Yara (CSNSM, Univ Paris-Sud)

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Presenter: Ms HADDAD, Yara (CSNSM, Univ Paris-Sud)

Session Classification: Nuclear reactors and medical physics

Track Classification: Nuclear Physics

Contribution ID: **36** Type: **Poster**

Interaction mechanisms between actinides and a protein: the CALMODULIN

Monday, May 9, 2016 3:30 PM (1 hour)

Considering the environmental impact of the Fukushima nuclear accident, it is fundamental to study the mechanisms governing the effects of the released radionuclides on the biosphere and thus identify the molecular processes generating the transport and deposition of actinides, such as neptunium and uranium. However, the information about the microscopic aspect of the interaction between actinides and biological molecules (peptides, proteins⋯) is scarce. The data being mostly reported from a physiological point of view, the structure of the coordination sites remains largely unknown. These microscopic data are indeed essential for the understanding of the interdependency between structural aspect, function and affinity.

The Calmodulin (CaM) (abbreviation for CALcium-MODULated proteIN), also known for its affinity towards actinides act as a metabolic regulator of calcium. This protein is a Ca carrier, which is present ubiquitously in the human body, may also bind other metals such as actinides. Thus, in case of a contamination, actinides that bind to CaM could avoid the protein to perform properly and lead to repercussions on a large range of vital functions.

The complexation of Np and U was studied by EXAFS spectroscopy which showed that actinides were incorporated in a calcium coordination site. Once the thermodynamical and structural aspects studied, the impact of the coordination site distortion on the biological efficiency was analyzed. In order to evaluate these consequences, a calorimetric method based on enzyme kinetics was developed. This experiment, which was conducted with both uranium (50 –500 nM) and neptunium (30 –100 nM) showed a decrease of the heat produced by the enzymatic reaction with an increasing concentration of actinides in the medium. Our findings showed that the Calmodulin actinide complex works as an enzymatic inhibitor. Furthermore, at higher neptunium (100 nM) and uranium (500 nM) concentration the metals seem to have a poison-like behavior and “kill” completely the enzymatic activity.

Author: Mr BRULFERT, Florian (IPN)

Presenter: Mr BRULFERT, Florian (IPN)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **37** Type: **Poster**

Diagnostic of transverse beam halo at the Accelerator Test Facility

Tuesday, May 10, 2016 10:15 AM (20 minutes)

The Accelerator Test Facility (ATF), a prototype of final focus system for next generation of future linear collider, aims to focus the beams to nano-meter transverse size and providing 12 nm stability. Achieving these goals will require modeling, measurement and controlling of the transverse beam halo before interaction point (IP). This paper presents a experimental study of the distribution and source of vertical and horizontal beam halo using diamond sensor at ATF. The beam profile with a vertical collimator upstream shows great agreement with the simulation results.

Author: Mr YANG, Renjun (LAL)

Co-author: Dr BAMBADE, Philip (LAL)

Presenter: Mr YANG, Renjun (LAL)

Session Classification: Poster session

Track Classification: Accelerator Physics

Contribution ID: **38** Type: **Poster**

New family of ab initio-driven Energy Density Functionals

Wednesday, May 11, 2016 2:30 PM (20 minutes)

The recent development of nuclear many-body ab initio methods has extended their application range to middle-mass doubly-closed shell nuclei and light doubly-open shell ones in the past few years, but heavy nuclei are at the moment out of reach. On the contrary, energy density functionals (EDF) have been around for decades, covering the whole nuclear chart. However, being based on phenomenological parametrization and Pauli-violating density dependence, they have their own limitations.

Recently, a proposal has been made to combine state-of-the-art many-body methods such as Bogoliubov many-body perturbation theory (BMBPT) and Bogoliubov coupled cluster (BCC) with modern nuclear EDF
formalism in order to produce a new family of energy density functionals that is at the same time safer on the mathematical side and more predictive throughout the nuclear chart. The key idea is to use the expansion of the Schrödinger equation at play in those many-body methods to build a sound parametrization of the EDF norm and energy kernels, incorporating much needed correlations while avoiding the usual EDF's pathologies. The aforementioned many-body methods are based on the concept of breaking and restoration of symmetry, which makes them perfect candidates for this
project.

The present research project constitutes the topic of my PhD thesis. The first objective consists of validating the many-body formalism recently proposed on the basis of the attractive pairing Hamiltonian problem by testing results at second-order in BMBPT against exact Richardson solutions. Once this is done, second-order BMBPT kernels will be implemented in axial symmetry on the basis of a "generalised Gogny"effective vertex. Particle-number-restored calculations will be performed to adjust the free parameters entering the effective vertex on an appropriate set of experimental data. Eventually, calculations focusing on nuclei of current experimental interest will be realised to test the newly developed ab initio-based EDF method.

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Presenter: Mr ARTHUIS, Pierre (CEA/DRF/IRFU/SPhN)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **39** Type: **Oral Presentation**

Heavy Photon Search at JLab

Wednesday, May 11, 2016 11:15 AM (15 minutes)

The Heavy Photon Search (HPS) is an experiment held in Jefferson Laboratory to search for new heavy vector boson(s) (A') in the mass range of 20 MeV/c2 to 1000 MeV/c2. Such heavy photons could couple to electrons and be radiated in electron scattering before decaying into narrow e+ e- resonances which can be observed above the QED background. The experimental setup is using a new compact, large acceptance forward spectrometer, composed of a silicon vertex tracker and a PbWO4 electromagnetic calorimeter (ECal). The latter has been built by the IPN group. I will present the results of my studies for the ECal, in particular the most recent on the effect of geometry on the energy reconstruction. Understanding the QED background is also essential for this experiment and I will present my progress on developping a calculation adapted to our exact detector geometry.

Authors: Ms SIMONYAN, Ani (IPNO); Dr GUIDAL, Michel (IPNO); Dr DUPRE, Raphael (IPNO)

Presenter: Ms SIMONYAN, Ani (IPNO)

Session Classification: Hadronic physics

Track Classification: Nuclear Physics

Contribution ID: **40** Type: **Poster**

Study of the nuclear fission process by prompt gamma-ray spectrometry

Monday, May 9, 2016 3:30 PM (1 hour)

My PhD is done in cooperation between the SPHN at CEA Saclay and the SPRC at Cadarache. It consists in the study of the fission process and the deexcitation of the fission fragments. The first step is the analysis of an experimental campaign performed in 2012 at ILL in Grenoble (EXILL), in which a U-235 and a Pu-241 target were irradiated by a beam of cold neutrons. A unique feature of the experiment was the use of a large array of germanium detectors to measure gamma-rays coming from the deexcitation of fission fragments. The main aim is to obtain accurate values for gamma-ray transition intensities and nuclear energy level feeding during the deexcitation cascade, as well as the yields of the fission fragments pairs. These results will be afterwards compared with the fifrelin code developed at Cadarache and will be used to improve the relevant physical processes included in fifrelin (e.g. spin distribution at fission, energy sharing, neutron evaporation, gamma-ray cascade).

Author: Mr RAPALA, Michal (CEA Saclay)

Presenter: Mr RAPALA, Michal (CEA Saclay)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **41** Type: **Poster**

Improving Monte Carlo shielding calculations by learning the importance map

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Reference shielding calculations are usually performed with Monte Carlo codes. When simulating rare events with Monte Carlo methods, it is necessary to use variance reduction techniques to reduce the statistical uncertainty on the expected result. Most of these techniques require a prior knowledge of the problem in the form of a so-called importance map, which represents the average contribution to the score as a function of the phase space coordinates. An initial guess for the map is usually generated by deterministic methods.

The aim of my PhD is to study the possibility to dynamically refine the importance map, and thus accelerate convergence, using the information generated by the simulation itself. To this goal, we use statistical learning algorithms, which have recently shown very good performance at recognizing patterns, approximating complex functions and managing large data sets. I will illustrate how the deterministic ansatz and the learning algorithms influence the performance of the Monte Carlo simulation.

Author: NOWAK, Michel (CEA)

Presenter: NOWAK, Michel (CEA)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **42** Type: **Poster**

Polynomial axial expansion in the Method of Characteristics for neutron transport in 3D extruded geometries

Wednesday, May 11, 2016 2:30 PM (20 minutes)

In the recent years a solver based on the Method of Characteristics (MOC) allowing the treatment of
3D extruded geometries has been developed inside the TDT module of APOLLO3. The standard Step Constant (SC) approximation is used and results show an excellent agreement with Monte-Carlo simulations. However a fine mesh refinement is needed to converge, due to strong flux gradients. An improvement of this method is proposed: the results of the previous work show that the flux gradients are likely to be represented by a polynomial base along the vertical direction. Since most of the geometrical and physical heterogeneities are radially located, the Step Constant approach is preserved to represent the solution over the radial plane. As a matter of fact the strong irregularities in the geometrical meshes prevent from an efficient use of a polynomial expansion. On the contrary along the axial direction the computational meshes assume a Cartesian shape, well suited for a polynomial representation of sources and fluxes. A suitable polynomial development in this direction allows us to approximate the strong flux gradients without the help of a large number of axial meshes.

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Presenter: Mr GRAZIANO, Laurent (CEA)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **43** Type: **Poster**

Improvement of Nb-93m and Rh-103m measurement methodology for accurate reactor dosimetry

Monday, May 9, 2016 3:30 PM (1 hour)

Dosimetry in reactor aims to determine the neutron fluence received during an irradiation and to characterize the spectrum (energy distribution of neutrons). This technique is based on the analysis of the activity of irradiated dosimeters, such as Nb-93(n,□)Nb-93m and Rh-103(n,□)Rh-103m with energies emissions between 16 and 22 keV. The activity measurement of these dosimeters is conventionally performed by X-ray spectrometry, but the low-energy of emitted photons makes it difficult to derive reliable results with low uncertainties. Approaches to improve these characterizations are presented: it includes high accuracy efficiency calibration of a HPGe detector using both experiments and Monte Carlo simulation, improvement of the analytical fit of experimental points for low-energy photons, calculation of corrective factors for the measurement geometry (self-attenuation in the solid sample) and fluorescence effects. The knowledge of the decay data with the lowest possible uncertainties is also required, especially the intensities of X-rays emissions. For Nb-93m, decay data have been updated in 2013 and uncertainties about intensities are smaller than 2%. The last update of Rh-103m decay data have been published in 2002, uncertainties on X-ray emission intensities are higher than 7% and the last measurement occurred in 1979. To improve the knowledge of Rh-103m decay data, a new measurement will be performed in June thanks to specific irradiation of rhodium samples in ISIS reactor, followed by activity measurement using liquid scintillation and photon emission intensity using X-ray spectrometry. In addition, the measurement of K fluorescence yields of niobium and rhodium using monochromatic radiation (SOLEIL synchrotron) will provide further information on the K X-ray emission of both elements.

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Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **44** Type: **Poster**

J/ψ production in p+p collisions at $\sqrt{s}$ = 5 TeV in the ALICE experiment

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Collision of relativistic heavy ions produce a hot and dense matter constituted of deconfined quarks and gluons - the Quark-Gluon Plasma (QGP). Heavy quarks present a unique probe of QGP properties as, due to their large mass, they are created in the initial hard-scattering processes during the first stages of the collision. Hence they experience the whole evolution of the system. Measurements of products of hadronization of charm quarks can unveil information on the properties of the matter created in the collision.
Suppression of charmonia production in nucleus-nucleus collisions compared to proton-proton collisions due to Debye screening is one of the predicted signatures of the QGP. Nonetheless, recent LHC results hint that another production mechanism, recombination of charm - anti-charm pairs in present in the medium, also needs to be taken into account.
Measurement of charmonia production in p+p collisions presents an important reference for A+A measurement. Recent Pb+Pb data at $\sqrt{s_{NN}}$ = 5 TeV from LHC Run-2 are unique as they were recorded at the highest energy ever achieved in A+A collisions. Corresponding p+p data were also collected. In this poster, status of the analysis of J/ψ in p+p collisions at $\sqrt{s}$ = 5 TeV via dimuon decay channel in the ALICE experiment will be presented.

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Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **45** Type: **Poster**

Fast and Efficient Optical Cherenkov Detector for PET

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Positron emission tomography (PET) is a nuclear imaging technique widely used in oncology. Decay of the tracer emits positrons, which annihilate in the nearby tissue. Two gamma quanta with the energy 511 keV are produced by positron annihilation and allow one to reconstruct the annihilation vertex and distribution of the tracer activity in the body of the patient. The time-of-flight (TOF) technique allows one to improve the signal-to-noise ratio in full body scans and therefore the image quality, or, alternatively, to reduce the dose injected, keeping the same image quality. This technique measures the difference in time between the two annihilation photons in addition to their position. In this thesis we propose to develop an innovative detector using the Cherenkov photons produced by electrons from the photo-ionization conversions of 511 keV gamma. We expect to reach a time resolution better than 150 p. We propose to study two configurations. The first uses the heavy crystal as a Cherenkov radiator, the second uses the heavy liquid radiator. In both configuration the photo-multiplier optimized for the detection of the Cherenkov light will be used. The Ph.D. study will consist in the detectors simulation with Geant4 software, development of the detector concept, construction and commissioning of the mechanical and electronics part of the detectors. The final step will be the characterization and optimization of the detector performances and extrapolation of the developed technology to the “clinical size”PET detector.

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Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **46** Type: **Poster**

Development of new metrology protocols of chalcogenide materials related to elaboration parameters

Monday, May 9, 2016 3:30 PM (1 hour)

Chalcogenide materials (based in S, Se and Te) have unique electrical and optical properties; they have the ability to change from amorphous to crystalline phase when an electric current is applied. This phenomenon makes them a reference in new applications such as electronic memories (Phase Change RAM and Conductive Bridge RAM) and in optronics (Photonics and photovoltaics applications). In order to industrialize these films, chemical composition, depth profile, surface and interfaces effects need to be well known and well controlled. Current techniques used in industry (such as EDXRF, TEM, RBS and TOFSIMS) can determine these parameters but they are destructive or time-consuming, so they are unproductive to be applied in an industrial in-line environment. X-ray techniques can provide precise and accurate measurements and at the same time they are non-destructive methods. For example, combined analysis by Grazing Incidence X-ray Fluorescence (GIXRF) with X-Ray Reflectivity (XRR) can provide depth-profile composition and density of multilayered samples.
In this work, metrology protocols based in x-ray techniques will be developed to characterize novel chalcogenide materials and their integration in complex technological stacks. Wavelength Dispersive X-ray Fluorescence (WDXRF) will be employed to study the chemical composition, while the combined analysis GIXRF/XRR and Angle-Resolved X-Ray Photoemission Spectroscopy (ARXPS) will be applied to investigate surface/interface effects and depth profile analysis. Furthermore, experiments with low-energy (35-1800 eV) and high-energy monochromatic x-rays (3-36 keV) will performed at the at the Metrology beam of SOLEIL synchrotron. The synchrotron-based metrology will complement laboratorial characterization in order to provide even more reliable measurements to better understand the chemistry of chalcogenide films and interfaces.
These protocols will be applied to chalcogenide films elaborated via magnetron sputtering. The sputtering parameters (working pressure, process temperature, power, and gas flow rate) will be evaluated to better understand the mechanisms of material deposition. Reactions at the interfaces will then be investigated so as to evaluate their impact on the local and average composition.

Key-words: Metrology protocols; X-ray techniques; XRF; XPS; Chalcogenides; Memory; Chemical composition.

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Presenter: Mr PESSOA, Walter (LETI CEA-Grenoble)

Session Classification: Poster session

Track Classification: Accelerator Physics

Contribution ID: **47** Type: **Poster**

Study of charge states of point defects and extended defects in uranium dioxide

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Recent experimental studies on oxides crystallizing in the fluorite structures (UO2, CeO2 or cubic ZrO2) have shown that under MeV electron irradiations, some atypic extended defects can be created in these materials. Faulted non-stoichiometric dislocation loops (disk-shaped interstitial oxygen layers) have already been seen. These observations raise the question about the point defect chemistry, defect clustering and charge transfers in iono-covalent insulators. Recent developments on many-body empirical potentials that use a charge equilibration method allow us to simulate various defects and their charge states.

The scope of this thesis is the study of point defects (formation and migration of point defects of different charge states) and dislocations (atomic and charge arrangements in the dislocation cores; interactions with point defects) in uranium dioxide in the framework of molecular statics and molecular dynamics.

In a second time results from these simulation will be used and integrated in a cluster dynamics algorithm to study the population and charge of clusters in uranium dioxide under irradiation.

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Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **48** Type: **Oral Presentation**

Cosmology and fundamental physics with extragalactic gamma rays

Tuesday, May 10, 2016 4:45 PM (15 minutes)

Very high energy gamma rays (VHE, > 100 GeV) propagating over cosmological distances interact with the extragalactic background light (EBL) which is the second most intense background in the Universe after the cosmic microwave background. Observations of spectral features in the VHE band of extragalactic sources related to this energy-dependent absorption process with the H.E.S.S. array of Cherenkov telescopes allow for a unique model independent measurement of the EBL energy distribution, otherwise very difficult to determine.
Second order processes to the propagation of such extragalactic gamma rays can also be used to probe magnetic fields in cosmic voids or to test potential effects violating Lorentz invariance.

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Session Classification: Cosmology and astroparticles

Track Classification: Cosmology & Astroparticles

Contribution ID: **49** Type: **Poster**

Study on X-ray diagnosis for phase topology during corium-sodium interaction

Wednesday, May 11, 2016 2:30 PM (20 minutes)

In case of a severe accident scenario in sodium-cooled fast reactors, due to transient over power accident (TOPA) or unprotected loss of flow accident (ULOFA) the fuel might melt generating a hot mixture named corium. When the hot molten fuel (≈ 3000 K) issuing from the degraded core comes in contact with sodium, molten fuel-coolant interaction (FCI) will occur, which can be explosive. The violence of the vapor explosion is strongly linked to the heat exchanges between the melt droplets and the surrounding sodium. Therefore, the knowledge of the local distribution of melt droplets with respect to the local vapor fractions i.e. the three phase distribution (corium, liquid sodium and vapor sodium) is one of the key points.
In an existing facility at CEA Cadarache, named KROTOS dedicated to corium-water interaction; an X-ray radioscopic device and an associated image processing algorithm KIWI have been developed to determine the phase repartition. To obtain an experimental understanding of the behavior of corium in various configurations (interaction with water and also sodium), CEA is building a large scale corium facility PLINIUS 2. In this facility, an X-ray radioscopic device and associated image processing is being developed to visualize and analyze an interaction mechanism of corium with sodium. This research aims at adapting this device to the peculiarities of corium-sodium interaction and in particular to the smaller corium drop/debris sizes formed during the interaction of corium with sodium. Basic idea will be to first design a phantom which will represent corium fragments and will have similar attenuation properties with that of corium. Thus the existing X ray radioscopic device can then be adapted to visualize the phantoms by optimizing its parameters. A physical simulation by pouring a large mass of such phantoms in front of a Linear accelerator can then help in obtaining images. The obtained images can be analyzed by improving the image processing algorithm KIWI and making it suitable to attain an understanding of the phase distribution during corium-sodium interactions.

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Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **50** Type: **Poster**

First Spectroscopy of the R-process Nucleus 110Zr

Wednesday, May 11, 2016 2:30 PM (20 minutes)

The structural evolution on the far neutron-rich side of stability is critical for defining the features of the elemental abundance distribution created during the rapid-neutron capture process (r-process). A potentially large shell-gap was historically predicted at N=70 in ^{110}Zr, which could significantly modify the r-process abundances before the A=130 peak. Recent lifetime measurements in the region suggest however that ^{110}Zr is well deformed. We present the first direct data on the structure of this nucleus, spectroscopy of the low-lying 2+ and 4+ states, and will discuss the agreement with the available theoretical predictions.

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Presenter: HUPIN, Nancy (CEA Saclay)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **51** Type: **Poster**

Search for a sterile neutrino with the Stereo detector

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Neutrino physics stays beyond the Standard Model. If neutrino oscillation involving masses mixing between three neutrino flavours seems today a valid theory, there are some hints for other neutrino families. The "reactor neutrino anomaly" is one of them and puts forward a deficit of electronic antineutrinos at short distance. This deficit can be interpreted as the existence of a *sterile* neutrino, apparent only through the oscillation mecanism.

The Stereo experiment aims to confirm of infirm this hypothesis of a new neutrino oscillation thanks to a segmented detector placed close to a nuclear reactor core, source of electronic antineutrinos. Detection is based on liquid scintillator technique with a Gadolinium doping. An antineutrino interacting in the liquid via the so-called *inverse beta decay* will be identified through a time-related coincidence between a prompt and a delayed signal, after the neutron diffusion and capture. The major challenge of the experiment is to discriminate the neutrino signal with enough precision from the high environmental background (cosmic muons, gammas from reactor…).

Within this frame, it is crucial to estimate correctly and reduce the systematics. It involves a deep understanding of the detector and of its response, especially via a reliable simulation. Analysis tools are used to extract the neutrino spectra from the background, and errors due to accidental and correlated background have to be mastered.

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Presenter: BONHOMME, Aurélie (CEA)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **52** Type: **Poster**

Structure of exotic nuclei. Spin-oriented radioactive beams for nuclear moment and beta-decay studies.

Wednesday, May 11, 2016 2:30 PM (20 minutes)

PHENIICS School

Research thematic: nuclear physics.

Laboratory: Centre de Sciences Nucléaire et de Sciences de la Matière (CSNSM)

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Title: Structure of exotic nuclei. Spin-oriented radioactive beams for nuclear moment and beta-decay
studies.

The study of the subatomic world started with the study of the stable nuclei. We found this kind of nuclei on earth, forged by stars several billion years. These nuclei are in equilibrium, their cohesion is such that no radioactive transmutation is possible.

The main interest of the contemporary nuclear structure is focused nowadays on the properties of the nuclei far from the stability line (exotic nuclei) where phenomena are being observed. For example, modifications of the nuclear shell structure are observed at extreme proton-to-neutron ratios. This brings in variations in the nuclear magic numbers well established around the valley of stability.

When discussing a possible modification of the nuclear shell structure far from stability, important ingredients are the purity of the nuclear wave functions and the shape (deformation) of the nuclei. Those two can be experimentally approached through nuclear moment studies. The magnetic dipole moment is very sensitive to the proton/neutron character of the valence nucleons and the purity of the wave function. The electric quadrupole moment is the experimental observable that can give the closest indication to the deformation and the shape of a nuclear state.

The experimental determination of nuclear moments requires the investigation of ensemble of spin-oriented nuclei. Different methods could be applied in order to obtain those spin-oriented ensembles, depending on the lifetime of the state of interest.

For example, ground-state nuclear orientation for neutron-rich nuclei could be obtained using the Tilted Foils Technique (TFT). It has already been tested after REX-ISOLDE and will be applied for magnetic moment studies of the 127,129In nuclei in the vicinity of the 132Sn. This should allow to shed light on the nuclear structure around this doubly-magic nucleus.

For shorter-lived nuclear states, the spin-orientation is usually obtained in the reaction mechanism that populates the state of interest. An experiment has been carried out at ALTO (Orsay) in order to investigate the level of spin-orientation in incomplete fusion reactions like (7Li,αpn) and (7Li,αn). The 7Li beam was sent to a 64Ni target in order to produce microsecond isomeric states in 65Ni and 66Cu. The gamma-rays from the decay of those isomers were detecting using the Ge detectors from the ORGAM array. The results of this experiment will be presented and the obtained spin-orientation will be discussed.

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Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **53** Type: **Poster**

Interplay between nuclear reactions and many-body methods

Wednesday, May 11, 2016 2:30 PM (20 minutes)

Even though the physics of atomic nuclei is a low-energy realization of QCD, a direct link between the two is concealed by the strongly coupling nature of QCD at low energies. Nevertheless, exploiting the separation of relevant low- and high-energy scales, chiral EFT, built only on nucleons and pions degrees of freedom, generates an implicit connection, providing a systematic framework that keeps track of the symmetries of QCD (and their breaking). As such, what is currently denoted as the ab initio nuclear A-body problem is nothing but chiral EFT implemented in the A-body sector. This theoretical scheme has to be based on an ordering of the term of the Hamiltonian (the so-called power counting), respecting the symmetries, that have to be kept at a certain order of truncation. Such a power counting should ensure several properties such as renormalizability at each order and control of the uncertainties introduced by the truncation. This is not the case with the classical (Weinberg) power counting based on a simple dimensional analysis. However for simpler Hamiltonian such as pionless EFT it has been partially done. Studying fully in details this simpler theory will allows us to better understand EFT mechanisms before tackling the more challenging case of chiral EFT.

One important aspect is the application to many-nucleon systems where many-body methods introduce additional theoretical uncertainties. My work here would be to verify the control of those uncertainties and the renormalizability of pionless EFT in the cleaner case of nuclear matter and then to finite medium mass nuclei using self-consistent Green function many-body approach. It should enable us also to assess if and where contributions beyond three-body terms are necessary for the truncated Hamiltonian to have those good properties.

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Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **54** Type: **Poster**

Light yield and energy resolution studies for the SoLid phase I

Monday, May 9, 2016 3:30 PM (1 hour)

The SoLid experiment is searching for sterile neutrinos from a nuclear research reactor. It looks for inverse beta decays (a positron and a neutron in delayed coincidence) with a very segmented detector made of thousands of scintillating cubes. SoLid has a very innovative hybrid technology with 2 different scintillators. The cubes are made of Polyvynil-Toluene (PVT) to detect the positrons and 6 LiF:ZnS sheets are put on one face of each PVT cube to detect the neutrons. The scintillation signals are brought by wavelength shifting fibers to MPPCs. It allows us to do an efficient pulse shape analysis to identify the signals from neutrons and positrons. The first module SM1 (288 kg) took data in 2015 and the construction of SoLid phase 1 (~ 1.5 t) is about to start. To improve the energy resoluton of SoLid phase 1, we have tried to increase the light yield. To study the positron light yield on the PVT, we have built a test bench with a 207 Bi source.
We have improved the design of the cubes, their wrapping or the type and the configuration of the fibers. We managed to increase the PVT light yield by about 40 % and improve the resolution of the
positron energy on the test bench from 20 % to 16 % at 1 MeV.

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Presenter: Ms BOURSETTE, Delphine (LAL)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **55** Type: **Poster**

Data analysis and sensitivity enhancement of the CUORE experiment via the development of Cherenkov hybrid TeO2 bolometers

Wednesday, May 11, 2016 2:30 PM (20 minutes)

My thesis subject deals with neutrino physic. In particular it is connected to the CUORE experiment, whose purpose is to search for the neutrinoless double beta decay of 130Te, through the use of bolometers based on TeO2. My thesis deals with the data analysis of the current experiment, but also with the design and the test of an innovative type of bolometer that will enhance the sensitivity of CUORE. Nowadays CUORE is one of the most sensitive double beta decay search, but it is not a 0 background experiment. About 50 events/year*ton of background are expected. With the innovative technique proposed in my thesis subject, it is possible to reduce it by almost 2 order of magnitude. In the CUORE experiment the expected signal is a peak at 2.5MeV, and at this energy the dominant background is due to energy degraded alphas emitted by a surface contamination. The solution of this problem can be the exploitment of the Cherenkov light. In fact, the Cherenkov emission in TeO2 has a threshold of 50 keV for electrons and 400 MeV for alpha particle. The electrons emitted in a double beta decay process have an energy much higher than the Cherenkov light threshold, while the alphas of the same energies are well below it. Globally, 100 eV are collected in form of Cherenkov light produced by two electrons with a sum energy of 3 MeV. A standard bolometric light detector, made of a Germanium wafer glued to a doped-semiconductor thermal sensor, is not capable to reach the sensitivity necessary for this measurement. It is indispensable to design a new more sensitive device. The idea is to exploit the Luke effect, consisting of a voltage-assisted amplification of the thermal signal of the bolometric light detector. This approach allows in principle to measure a single optical photon. In our case it is enough to reach 20 eV sensitivity.

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Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **56** Type: **Poster**

Phase contrast imaging on X-ray laboratory source

Monday, May 9, 2016 3:30 PM (1 hour)

X-ray phase contrast imaging, in addition to classical attenuation imaging, has a lot of interest due to its high differentiation capability for low density materials. However, despite classical radiography, phase signal has to be retrieved by adding experimental material and/or applying sophisticated phase retrieval algorithm [1]. Best performances are achieved on synchrotron source but in medical or industrial context, application on X-ray laboratory source has a real interest. Our approach is based on multilateral interferometric technique [2]. This technique consists in measuring the phase gradient in at least 2 orthogonal directions with a single phase grating. The phase retrieval treatment can be made in the frequency domain due to the regularity of the grating. A strong property of this technique is the redundancy in the wave front measurement [3]. In this way direct noise evaluation, phase dislocation and frequency under-sampling indication can be proceeded and taken into account during the phase retrieval procedure.

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Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **57** Type: **Oral Presentation**

High resolution imaging of maize stem with time-of-flight secondary ion mass spectrometry

Wednesday, May 11, 2016 9:15 AM (15 minutes)

In the study of converting cellulosic plants into biofuels, much attention has been paid to maize stalk for its vast biomass production and great potential in bioethanol generation [1-3]. However, high lignification of cell walls in maize stem has significantly prevented the accessibility of enzymes, microorganisms or chemicals to cell wall polysaccharides, thus leading to a low efficiency in the conversion [4]. Our objective is to analyze lignin distribution and evaluate the lignification in maize stems by TOF-SIMS imaging [5,6], which will facilitate the selection of potential phenotypes for biofuel production as well as to provide clues in building new genotypes to obtain desired lignin distribution pattern or to downregulate general lignin production.
Preliminary imaging experiments were performed with a commercial TOF-SIMS IV mass spectrometer (ION-TOF GmbH, Münster, Germany) with bismuth cluster ions (Bi3+, 25 keV) as the primary ion beam. The so-called burst alignment ion beam focusing mode was utilized to obtain a high spatial resolution, followed by applying a delayed extraction of secondary ions to retain the high mass resolution routinely generated in high current bunched ion beam focusing mode [7]. To neutralize the charges accumulated on the insulating surface, a low energy pulsed electron flood gun was applied during all the acquisitions. Small areas of 400 μm × 400 μm corresponding to vascular bundle and ground tissue of maize stem were mapped, respectively.
With above instrumental settings, the distribution of different lignin types on maize stem section was mapped with high mass and spatial resolution. G/S ratios of cell walls in different cell types were calculated to predict the degradability of cell wall lignin. Moreover, lignin deposition pattern in the side wall of metaxylem vessel was directly visualized thanks to the high spatial resolution. In addition, the localization of inorganic calcium might prove its association with cell wall pectine, which could further strengthen the cell walls in maize stem.

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Presenter: FU, Tingting (IPN & ICSN)

Session Classification: Accelerator physics

Track Classification: Accelerator Physics

Contribution ID: **59** Type: **not specified**

Looking for the neutrinoless double beta decay with the SuperNEMO detector

Tuesday, May 10, 2016 12:00 PM (15 minutes)

The SuperNEMO experiment is looking for the neutrinoless double beta decay which, if observed, would prove the Majorana nature of the neutrino. Under the assumption neutrinos are indeed identical to their antiparticles, the detector could not only constrain the effective neutrino mass but also identify precisely the mechanism responsible for the neutrinoless double beta decay among the several hypothesized today (light Majorana neutrino exchange, Right-Handed Currents,etc…). The unique detector design combines tracking and calorimetry techniques allowing a full event topology reconstruction and thus, a powerful background identification and rejection. It also gives access to other rare processes such as the double beta decay to the excited states of the daughter nucleus.

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Session Classification: Beyond standard model

Track Classification: Particle Physics

Contribution ID: **61** Type: **Poster**

Monte Carlo simulation and imaging dose estimation for a kilovoltage cone-beam CT unit

Tuesday, May 10, 2016 10:15 AM (20 minutes)

The accuracy of patient and tumor localization for radiotherapy treatments has been improved by the emergence of radiographic image guidance. However, intensive use of Imaged-Guided Radiotherapy (IGRT) could add a significant extra dose to normal tissues and potentially amplify the risk for patients to develop a secondary radiation-induced cancer and side effects. The purpose of this Ph.D study is to understand and estimate the dose from the Cone Beam Computed Tomography (CBCT) unit mounted on the medical Elekta Synergy linear accelerator.

The most accurate tool to evaluate the amount of radiation delivered by CBCT is the Monte Carlo (MC) method. Hence, we developed a dose calculation tool based on the MC method and suitable for clinical environment, and validate it in pre-clinical conditions thanks to measurements performed on the Elekta linac available on the DOSEO platform. This simulation tool allows studying several strategies to integrate the additional dose due to CBCT imaging into the treatment planning optimization.

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Presenter: Ms CHESNEAU, Héléna (CEA)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **62** Type: **Oral Presentation**

The EUSO-BALLOON instrument and evaluating the performance of PDM

Tuesday, May 10, 2016 5:00 PM (15 minutes)

The EUSO-Balloon telescope is composed by a PDM, which is a phatfinder of one of the 130 PDM the front-end of the JEM-EUSO telescope. JEM-EUSO is the telescope that have like aim the detection of the UHECR watching the Earth's atmosphere from the space (inside the Japanese module of ISS)The first focus of this work was the integration of PDM and the corresponding validation test . Inside this, the EC-ASIC components are the responsible for signal amplification and digitalization,and these were strongly affected by electrical noise system.
At this step, some adaptations and recommendations were made for the new design of EC-ASIC(SPACIROC3 based).After participating in the test validation telescope EUSO-BALLOON, I participated in the mission flight where during a night of 5 h at Timmins Ontario, the telescope successfully worked and this record the background noise and the beam of a laser carried by a helicopter to 30 km below the telescope's Balloon, which simulates the extensive air showers.
The next stage of the thesis was the participation in the absolute post-calibration of the PDM. It was essential for data analysis.
It was observed that more than 60% of the pixels had a efficiency below 15%.
For this reason in the last part of this thesis a proposal for retrieving information from these bad pixels is done, using the poor signal which corresponds to the signal of 2 photon-electrons and besides to electronic efficiency based on the analysis of the S-Curve of each pixel, independent of absolute efficiency. A complementary part around this work was the test of algorithms of trigger over light-sources which simulated the EAS, meteors and the cities, realized at Turlab -INFN/Turin.

Author: Mr RABANAL REINA, Julio Arturo (EUSO-BALLOON)

Presenter: Mr RABANAL REINA, Julio Arturo (EUSO-BALLOON)

Session Classification: Cosmology and astroparticles

Track Classification: Cosmology & Astroparticles

Contribution ID: **63** Type: **Poster**

Experimental constraints on models with light scalar field in cosmology and particles physics (SNLS/eBoss experiments and CMS experiment at the LHC).

Tuesday, May 10, 2016 10:15 AM (20 minutes)

The current standard models, both in particle physics and cosmology, have been largely validated experimentaly with an unprecedented precision to this day. Yet, these models are not able to answer several important questions of modern physics. Two of them concern the nature of Dark Energy and Dark Matter, that have been highlighted from astrophysical and cosmological observations.
Several models have been proposed to address these issues, and this thesis aims at putting some experimental constraints on models with additional light scalar fields for both particle physics experiments and cosmological observations.
In particle physics, I am studying the branon model that provides an answer to the nature of Dark Matter, by comparing the results of a search for monojet and single hadronically decaying vector boson productions in the CMS data from Run 2 of LHC with the predictions of known processes.
In cosmology, the goal is to put constraints on the galileon model, which aims at describing the late acceleration of the expansion of the Universe. To achieve this goal, I am using all the available cosmological observables measurements, namely : SNIa, BAO, growth rate of structures and the full angular power spectrum of temperature of the CMB. The focus will be on the latter, which constraints have yet to be derived.

Author: Mr LELOUP, Clement (Irfu)

Presenter: Mr LELOUP, Clement (Irfu)

Session Classification: Poster session

Track Classification: Cosmology & Astroparticles

Contribution ID: **64** Type: **Poster**

Nuclear structure of the neutron-rich silver isotopes by collinear laser spectroscopy.

Monday, May 9, 2016 3:30 PM (1 hour)

The hyperfine structure splitting (hfs) and isotope shifts (IS) in the atomic transitions 4d10 5s 2S1/2 −4d10 5p 2P3/2 will be measured for the isotopes 111-120Ag. The technique of choice will be collinear laser spectroscopy. A continuous-wave laser beam will be overlapped with the radioactive beam and at a precise set of laser frequencies the atoms fluoresce in the transitions of their hyperfine structure. A code to adjust the data was compiled and tested with data obtained in previous experiments. Nuclear spins, magnetic dipole, electric quadrupole moments and changes in mean square charge radii have been determined in good agreement with the literature values.

Author: Ms VAZQUEZ RODRIGUEZ, Liss (PhD)

Presenter: Ms VAZQUEZ RODRIGUEZ, Liss (PhD)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **65** Type: **Poster**

Study of RF power couplers for high power proton linear accelerators

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Nowadays, the number of projects aiming at building high intensity proton linear accelerator is increasing thanks to a large field of applications: particles physics, nuclear physics, spallation source and some applications in material sciences, biology and nuclear waste reprocessing. All these linear accelerator projects are based on superconducting technology that allows high accelerating gradients in continuous mode.
The RF power coupler is one of the main components of the accelerator. It is designed to transmit the radio frequency power from the waveguide at room temperature to the cavity at 4 Kelvin. It is not only a vacuum barrier (between cavity space under vacuum and waveguides under atmospheric pressure) but also a thermal barrier between room temperature and cryogenic temperature of the cavity.
The aims of this PhD work are, to take account of the fabrication processes during the conception of couplers. These processes have an important influence on couplers performance and they are not usually included in development studies.
Last years, I performed Electromagnetic simulations (HFSS and CST), thermal and thermo-mechanical simulations (Ansys), to build a prototype of a coupler at 704.4MHz.
I will have the opportunity to perform conditioning and high power tests on this device next summer.
In order to build 352MHz high power coupler prototype, I have simulated electromagnetic characteristics of a proper design and its response to mechanic and thermic stresses. A prototype will be built next year and it will be tested with new klystron, as radiofrequency source, at IPNO.
Simultaneously, in order to study thin layer deposition on coupler's ceramic window and their impacts on multipacting, I am simulating multipacting (electron avalanche in resonance with RF wave) with Musicc3D, a code developed at IPNO.

Author: Mr GESLIN, Florian (IPNO/Thales)

Co-authors: Mr LESREL, Jean (IPNO); Dr CHABOT, Marin (IPNO)

Presenter: Mr GESLIN, Florian (IPNO/Thales)

Session Classification: Poster session

Track Classification: Accelerator Physics

Contribution ID: **66** Type: **Poster**

Study of the semileptonic decay $\Lambda_b^0 \to \Lambda_c^+ \tau^- \bar{\nu}$ with the LHCb experiment

Monday, May 9, 2016 3:30 PM (1 hour)

Semileptonic B decays with a τ-lepton are a very interesting tool to probe the Physics beyond Standard Model. Besides its precise theoretical predictions due to lepton flavor universality it has been a hot topic since the evidence of a slight disagreement between BaBar, Belle and LHCb measurements
and the SM expected value of $R(D^*)$. This gives us a chance to detect the presence of New Physics such as
a charged Higgs boson, $H^\pm$ or to put major constraints on models including such particles.

Studying $\Lambda_b^0 \to \Lambda_c^+ \tau^- \bar{\nu}$ with the decay of the tau in three charged pions allows a precise reconstruction of the τ vertex and thus, permits the reconstruction of the Λ_b^0 and τ momenta. The analysis is possible thanks to a new method called "vertex inversion" which permits to distinguish signal events from prompt $\Lambda_c^+ 3\pi$ events.

This ananlysis will lead to the first measurement of $BR(\Lambda_b^0 \to \Lambda_c^+ \tau^- \bar{\nu})$, a measurement of the ratios of branching ratios with a tau and with a muon : $R(\Lambda_c)$.

The feasibility of this analysis is now demonstrated and the implementation of analysis tools such as isolation against neutral and charged tracks or partial reconstruction of the background is under study.

Author: Mr RENAUDIN, Victor (LAL)

Presenter: Mr RENAUDIN, Victor (LAL)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **67** Type: **Poster**

The quest for super heavy element island of stability using fission times measurements.

Monday, May 9, 2016 3:30 PM (1 hour)

Fission barriers of a few MeV induced by shell effects are predicted using macroscopic-microscopic structure model leading to the formation of the so-called island of stability for super heavy nuclei. Its position should be centered around new magic numbers expected at N=184, and between Z=114 and Z=126 depending on the model used for calculation.

Super heavy nuclei are synthesised by fusion-evaporaton process but the cross sections are very low (order of picobarn for element Z=110-118) and decrease with Z, which makes it an experimental challenge. The survival of heavy compound nucleus is indeed deeply threaten by fission process which is the dominant decay mode. Thus a new method for study of super heavy element stabtility has been developped by our team. It is based on fission times measurement using crystal blocking technics [1] or more recently X-rays fluorescence [2].

X-rays emission caused by filling of K-shell electronics hole proves the existence of a super heayv nucleus with long fission times. Those fission times must be higher than the k-shell hole lifetimes, which are about 10-18s for element with Z=120. Fisson times are a sensitive tool to study statbility as they are directly correlated with fission barriers induced by shell effects.

This method has been applied to measure fission times of element Z=124 during the E651 experiment which took place in GANIL (Caen) in march 2014. A uranium 238 beam at 6,6 MeV/A was sent on 2 different isotopic germanium targets. X-ray spectrum is measured thanks to 3 germanium detectors located at a distance of 4cm from the target, corresponding to an over-all solid angle close to 1 sr. Identification of heavy compound nuclei is made possible with detection and Z-identification of the two fission fragments using identification telescopes. Those telescopes are composed of an ionisation chamber followed by a double-striped silicon detector.

[1] M.Morjean et al., Phys. Rev. Lett. 101, 072701 (2008)

[2] M.O. Frégeau et al., Phys. Rev. Lett. 108, 122702 (2012)

Author: AIRIAU, Maud (IPN)

Presenter: AIRIAU, Maud (IPN)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **68** Type: **Poster**

Recherche du boson du Higgs du Modele Standard dans le canal de desintegration en deux leptons taus avec l'experience ATLAS au LHC

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Je suis en dernière année de thèse dans le groupe de recherche de Higgs en deux leptons taus dans ATLAS au laboratoire de l'accélérateur linéaire à Orsay. Durant ma 1ére année en 2013, j'ai travaillé dans le groupe de performance du lepton tau dans ATLAS et j'ai participé dans l'amélioration de la reconstruction et l'identification de ce lepton. Un lepton tau se désintegrent soit en canal leptonic (avec un autre lepton moins massif, electron ou muon , et des neutrinos dans l'état final), soit en canal hadronique (avec a jet des particules hadronique dans l'état final). Ce dernier est le plus difficile dans l'environement hadronique du LHC. Cela faisait ma tache de qualification dans cette grande collaboration (ce sont des ensembles des taches que chaque nouveau membre dans ATLAS doit les faire pour etre qualifié). Après, j'ai commencé mon travail dans le groupe d'analyse physique pour la recherche du signal du boson du Higgs se désintègrant en deux leptons taus. Ma thése est basée sur les nouvelles données du LHC avec une énergie de 13TeV dans le centre de masse. Concernant mon travail dans le groupe d'analyse dans ATLAS, qui est la partie principale dans ma thèse, j'ai participé à l'analyse depuis la reprise de données. Sachant qu'il y a beaucoup des choses qui ont changé avec le nouveau Run du LHC, j'ai travaillé sur la création des nouveaux frameworks qui sont utilisés maintenant pour faire la production des fichiers de simulations Monte Carlo et des données nécessaire pour l'analyse finale. La prédiction de bruit de fond du signal H->tautau. C'est un canal avec un grand bruit de fond dominé par le fond QCD et le processus Z->tautau. Maintenant j'ai commencé à travailler sur la dernière chaine de l'analyse qui est le framework qui va faire le fit pour extraire le signal (H->tautau) dans cette canal de désintegration. Durant toute cette periode, j'ai toujours bénéficié de l'orientation de mon directeur de thèse, Luc Poggioli. Il est disponible pour repondre à tous mes questions et m'aider tout le temps.

Author: AYOUB, Mohamad (Physique des particules)

Presenter: AYOUB, Mohamad (Physique des particules)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **69** Type: **Poster**

Porosimetry of zirconia scales formed during oxidation of Zr-based fuel claddings in steam and air-steam mix at high temperatures

Wednesday, May 11, 2016 2:30 PM (20 minutes)

This poster presents the main results of a study conducted to quantify the degradation state of Zr-based fuel claddings submitted to severe accident conditions in a nuclear reactor core: high temperatures and pure steam or air-steam mix. Due to the progressive thickening of a dense and protective ZrO2 layer, the oxidation kinetics of Zr-based claddings in steam, at high temperatures typical of nuclear severe accidents, is generally (sub-)parabolic. However, for some temperature domains, this oxide layer may crack, becoming porous and non-protective anymore. In these 'breakaway' conditions, the oxidation kinetics accelerate. Additionally, the temperature rise can lead core materials to melt and to relocate down to the vessel lower head, threatening its integrity. If it fails, and for specific conditions, air ingress may take place into the reactor. Hence, oxygen and nitrogen react with Zr-based claddings, successively through oxidation of Zr (forming ZrO2 layer), nitriding of Zr (forming ZrN particles) and oxidation of ZrN (forming ZrO2 and releasing nitrogen). These self-sustained reactions enhance the deterioration of Zr-based claddings and of their ZrO2 layers, increasing their open porosity. To quantify this porosity, a series of two-step experiments was conducted. First, ZirloTM cladding samples were isothermally oxidized in various conditions: in pure steam or in a 50-50mol% air-steam mix, at several temperatures, and for different durations. The main thermal effects on kinetics and the high impact of air on the cladding degradation are confirmed by experimental results. Second, pioneering porosimetry measurements by Hg intrusion were realized on such corroded cladding samples. In both atmospheres, it is pointed out that 1250 K lead to particularly porous oxide layers, especially due to strong 'breakaway' effects. Moreover, it is confirmed that the presence of air strongly enhances the oxide cracking. Finally, it is observed that in all conditions, the porous volume fraction of ZirloTM claddings continuously rises during their corrosion process.

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Presenter: Mr HAURAIS, Florian (EDF RetD)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **71** Type: **Oral Presentation**

NUCLEAR REACTOR SIMULATIONS: A BIAS QUANTIFICATION OF NEUTRON LEAKAGE IMPACT

Monday, May 9, 2016 5:15 PM (15 minutes)

Monte Carlo codes are often used in nuclear reactor simulations to realize fuel evolutions as a function of time, in order to know the spent fuel composition at the end of the irradiation cycle.
The evolution of the entire reactor core is not possible with stochastic codes, because of the source convergence problem and the too costly machine time required.
So, a simple reactor model is adopted for calculations: instead of about 200 assemblies, differing for composition and irradiation level, a single entirely reflected assembly is simulated. The assembly model lies on many hypotheses, such as the neglecting of control rods and boron concentration for power regulation.
Since the geometry has reflecting boundary conditions, neutrons can not escape from the assembly. Taking into account or neglecting neutron leakage can lead to important biases in reactor simulations, since it has a strong impact on neutron spectrum. At the present time, homogeneous leakage models exist and are implemented in some Monte Carlo codes.
The study of neutron axial leakage and the comparison with leakage models will be presented.

Author: Mrs SOMAINI, Alice (doctorante)

Presenter: Mrs SOMAINI, Alice (doctorante)

Session Classification: Nuclear reactors and medical physics

Track Classification: Nuclear Physics

Contribution ID: **72** Type: **Poster**

Multi-objective Genetic based Algorithms and experimental beam lifetime studies for the SOLEIL storage ring

Monday, May 9, 2016 3:30 PM (1 hour)

The aim of this project is to optimize the nonlinear beam dynamics of the Synchrotron SOLEIL storage ring using Multi-objective Genetic Algorithm (MOGA). MOGA uses ELEGANT as a tracking code to compute the on- and off-momentum acceptances as optimization objectives and the quadrupole and sextupole setting magnets as optimization variables. The off- and on-momentum acceptances are strongly related to two important parameters impacting the accelerator performance: the injection efficiency and the beam lifetime, respectively.

A model of the current SOLEIL storage ring lattice with the physical limitations and the multipole field components is optimized with MOGA. Two optimized solutions have been selected after 1 month of computation in the SOLEIL computer cluster. After crosscheck and in-depth characterization with the Tracy3 code, they were tested experimentally in the control room of SOLEIL using beam-based experiments. The experimental results confirm the significant improvement of the beam lifetime obtained in the simulations: 40 % and 50 % with respect to the nominal lattice. The optimization scheme has been validated with a good predictive model.

In addition, a detailed study of the behavior of the beam lifetime was performed with important parameters during the machine operation as scraper dimensions, coupling, RF-voltage and current among others. The results allow understanding the relation between the beam, the Touschek and the gas lifetimes. There is a good agreement between the simulated and experimental Touschek lifetimes, especially for the internal scraper. However there is a discrepancy between the calculated and the experimental values of gas lifetime due to the difficulty to determine the effective atomic number and the mean pressure of the residual gas in the SOLEIL storage ring. Results will be presented in details.

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Co-author: Dr NADOLSKI, Laurent (Synchrotron SOLEIL)

Presenter: Mr GAVALDÀ, Xavier Nuel (Synchtron SOLEIL)

Session Classification: Poster session

Track Classification: Accelerator Physics

Contribution ID: **73** Type: **Oral Presentation**

A Snowball's Chance in Hell: The Hierarchy Problem in Particle Physics

Tuesday, May 10, 2016 11:45 AM (15 minutes)

The so-called "Hierarchy Problem" is one of the main driving forces behind the nowadays exploration of physics beyond the Standard Model (BSM). In its simplest form, the Hierarchy Problem asks why the weak interaction is $\sim 10^{30}$ times stronger than gravity. The goal of this presentation is to state the body of the problem in a precise yet accessible manner, with a particular emphasis on the concept of symmetry in particle physics. Afterwards, I will briefly discuss how this problem can be solved in various BSM theories, such as Supersymmetry, Compositeness and Extra Dimensions.

Author: Mr ANGELESCU, Andrei (CNRS / Univ. Paris-Sud)

Presenter: Mr ANGELESCU, Andrei (CNRS / Univ. Paris-Sud)

Session Classification: Beyond standard model

Track Classification: Particle Physics

Contribution ID: **74** Type: **Oral Presentation**

HIGH-GRADIENT S-BAND ELECTRON LINAC FOR THOMX

Wednesday, May 11, 2016 10:00 AM (15 minutes)

The THOMX project aims to design and build a compact X-rays Compton backscattering light source demonstrator resulting from collisions between laser pulses and relativistic electron bunches. The project was recently funded and is under construction in the Orsay University campus. The machine consists of a 50–70 MeV LINAC injector and a storage ring. The PhD program covers the linear accelerator research on many different aspects. The purpose is to increase the compactness of the accelerator complex whereas the beam properties for ring injection are kept. First, a LAL Orsay-PMB ALCEN collaboration on high-gradient S-band structure research for the LINAC upgrade has been established. The program foresees the RF design, thermal analysis, prototyping and power tests of a high-gradient compact S-band accelerating structure. The RF design has been carried out using 3D simulation codes like HFSS and CST MWS. The goals of these prototypes is to verify and validate all technical choices obtained by the simulations and to develop an effective fabrication procedure. Second, to fulfill the technical specifications at the interaction point, the LINAC must be carefully designed, especially the photo-injector. Beam dynamics simulations have been performed for optimizing the emittance and the longitudinal phase space for the ring entrance. Total beam emittance in the photo-injector has been minimized by means of emittance compensation. The best set of parameters across the laser spot size, pulse length and magnetic field strength has been determined. The effect of the accelerating section to the beam dynamics at the end of the LINAC are studied as well.

Author: Mr GAROLFI, Luca (LAL)

Presenter: Mr GAROLFI, Luca (LAL)

Session Classification: Accelerator physics

Track Classification: Accelerator Physics

Contribution ID: **76** Type: **Oral Presentation**

Development of new dosimetric standard for low energy X-Rays (≤ 50 keV) used in radiotherapy

Monday, May 9, 2016 5:00 PM (15 minutes)

Contact radiotherapy by X-Rays generator is a cancer treatment technique using low energy X-Rays (≤ 50 keV). This technique became more reliable after the latest evolutions of the X-Ray tubes, and hence, led to the development of new treatment devices, such as INTRABEAM® and Papillon 50®. The irradiation is done in contact with the tumor so it receives a high dose while preserving neighboring healthy tissues. Different applicators are used with such devices to treat diverse types of cancer. These applicators vary the form of emitted beams, i.e. collimated or over 4, and hence, they vary the spatial distribution of the absorbed dose that is delivered during the treatment. To provide the prescribed dose to patients using such devices, the medical physicists rely today on the databases of absorbed dose distribution in water provided by manufacturers.
This thesis is aimed at establishing appropriate primary standard in terms of air kerma, Kair, and absorbed dose to water, Dw, in order to calibrate the relative spatial distribution of absorbed dose delivered during such treatment. Primary standard are established based on a free-air ionization chamber. Moreover, a new currently developed dosimetric gel is used to assess the 3D spatial distribution of the relative absorbed dose around the X-Rays source.
The first step was to demonstrate that the used gel was adapted to the low energy photon range. Then a protocol was developed to calibrate the gel, in terms of dose and energy response. The current step is to set the Kair and Dw standard. For this purpose, we are characterizing and reproducing some contact radiotherapy beams using a standard X-Rays generator available at LNHB. Moreover, the free-air ionization chamber used to establish the primary standard was modeled using several Monte codes in order to calculate factors required to correct for the effects of practical limitations on the measurement.

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Session Classification: Nuclear reactors and medical physics

Track Classification: Nuclear Physics

Contribution ID: **77** Type: **Poster**

CORROSION OF STEEL IN MOLTEN SODIUM NITRATE AT HIGH TEMPERATURE

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Concentrating solar power (CSP) systems which use concentrated sunlight to produce electricity by turning steam turbines have been receiving a lot of attention in recent years. However, as we all know, solar energy is a fluctuating resource because of the daily rotation of the earth, seasons and weather conditions. The challenge here is to store this energy and release it at the right time. An innovative thermal storage solution has been developed to apply to CSP plants with direct steam generation. Principle of the storage is using a phase change material (PCM) for storing and releasing thermal energy. During the storage phase, when the sun shines, the heat transfer fluid passes through a heat exchanger and transfers its heat to the PCM, making it to change phase from solid to liquid. The releasing phase is done with the same way, the heat transfer fluid is now heated in the exchanger, and in this case, the PCM passes from the liquid phase to the solid phase.
Today, molten salt is an important solvent system for high temperature applications. Nitrates melt are privileged materials to fill the role of material storage due to the high heat capacity, low melting point, and easy availability. However, the corrosion effects occur between the molten salt and the structural material using to make heat exchanger is always a major concern as corrosion is accelerated at high temperatures. Based on good understanding about the corrosion products, kinetics and mechanism of reactions of iron in fused salt nitrate, the design, operational conditions, the thickness of heat exchangers required for operation in a given period can be calculated.
In this work, the behavior of heat exchanger's structural material (low alloy steel) in molten sodium nitrate (NaNO3) was studied. Corrosion test of steel in NaNO3 at 340℃ by weight-loss method were conducted and corrosion rate was found to follow logarithmic kinetic:
Ep.(μm)=0,53*log(time(h))-0,2
In addition, DRX and Tof-Sims analysis performed at the end of corrosion test proved the formation of an oxides layer consist of an equimolar mixture of Fe3O4 and Fe2O3 on the steel's surface following these corrosion reactions:
3Fe + 4NaNO3 = Fe3O4 + 4NaNO2 (1) 2Fe + 3NaNO3 = Fe2O3 + 3NaNO2 (2)
Besides, the electrochemical behavior of steel in NaNO3 at 340℃ comparing to a platinum electrode in the same media is also investigated by electrochemical methods. The similarity of these i-E stationary curves obtained by chronoamperometry showed that corrosion of steel lead to formation of a protective and conductive oxide layer on the steel's surface. Impedance spectroscopy measurements were also performed to have additional information on corrosion kinetics and characteristics of the layers (resistance, capacitance⋯) and a corrosion mechanism of steel in NaNO3 at 340℃ is also proposed

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Presenter: Ms LE, Kim-Khanh (IPNO)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **78** Type: **Poster**

Charmonium production in pp and PbPb collisions with the CMS experiment

Wednesday, May 11, 2016 2:30 PM (20 minutes)

The measurement of Psi(2S) meson yield in PbPb collisions compared to the J/psi meson is used to study the modifications of the charmonium production in PbPb due to effects like melting in the quark gluon plasma and statistical recombination. Previous results reported by the CMS Collaboration using pp and PbPb data at sqrt(s_NN) = 2.76 TeV, have shown that the Psi(2S) meson is more suppressed than the J/psi at midrapidity and high pt (|y|<1.6. pt>6.5), but slightly less suppressed at forward rapidity and intermediate pt (1.6<|y|<2.4, pt>3). A new analysis is currently been performed using the pp and PbPb data collected at sqrt(s_NN) = 5.02 TeV by the CMS Collaboration, and a brief summary of the analysis will be presented during the Doctoral School Days (no results will be shown since it is an ongoing analysis).

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Presenter: Mr STAHL, Andre Govinda (LLR)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **80** Type: **Poster**

The impact of new clinical indicators (delivered dose and patient positioning) based on transit in vivo dosimetry using Electronic Portal Imaging Device (EPID) for adaptive radiotherapy.

Monday, May 9, 2016 3:30 PM (1 hour)

In vivo dosimetry consists in measuring in real time, during one or several treatment sessions, the dose actually received by the patient1Many researchers in the past year have improved methods to verify the correct dose delivery in the patient1. A simple method to determineIn the last 10 years the dose received by the patient during his treatment is to usehas been measured by an Electronic Portqal Imaging Device (EPID) already integrated to the treatment machine and placed below the patient during the fraction. The accuracy and the efficiency of the EPID has been discuss in the literature for many years.2
By comparing the dose predicted by the treatment planning system (TPS) to the dose received by the EPID –after conversion, we can evaluate the dose received by the patient at each fraction. There are many ways of comparing both transit dose. The first one Two main approaches are possible: i)is to predict an image from the patient planning Computed Tomography scan data (pCT) and to compare the acquired image during the fraction;. ii)Another way, -used in this PhD thesis, is to reconstruct the dose using back projection, from the EPID image. Both mentioned method use tolerance threshold to accept or reject the control. The first step is to give a quick and reliable statistical analysis to answer if the fraction was in or out the tolerance. In case of the latest a deeper analysis has to be done using dose/volume relation to find the root cause of this deviation. Transit dose analysis cannot inform of the "real"clinical impact of the deviation and the information of the "patient of the day"are required. Kilovoltage cone beam computed tomography (CBCT) produces volumetric images (with just one rotation of the x-ray source-detector pair)3 of the patient at the time of his fraction. An elastic registration from pCT to CBCT for the volume of interest, an –as much as possible- accurate conversion curve Hounsfield units (HU) to electronic density (deED) for both pCT and CBCT and "true"treatment machine information can inform of the clinical impact of the discrepancy.
The last part of this decision making tool is the need of correction of the treatment plan (Adaptive Radiotherapy –clinical decision making).

Watching the dosimetry of each fraction of the treatment should help to quantify and to check the delivered dose to the patient and then to be an indicator of the quality of the delivered treatment, concerning:

- the accuracy of patient (re-)positioning;
- the anatomical reproducibility and patient morphology;
- the constancy of the treatment machine and its accessories.

It should be easier to:

- Compare delivered/predicted and fraction to fraction,
- Cumulate real delivered dose, be alerted and then modify initial treatment plan,
- Enhance patient's treatment quality within the department

Key words: External Radiotherapy, in vivo transit dosimetry, dosimetric quantification, Adaptive Radiotherapy

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Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **81** Type: **Poster**

Looking at the Transverse Momentum Dependent content of the proton with quarkonia

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Transverse Momentum Dependent (TMD) factorisation is a systematic method to account for transverse part of parton momentum inside hadrons. In this formalism, the partonic scattering amplitude ("short-distance part" evaluated with Feynman rules) remains unmodified. It is instead factorised with correlators containing the transverse dependence.

TMD distributions are of great interest to improve our understanding of parton dynamics inside hadrons. For high energy hadron coliisions, in which gluon density prevails over quark, knowledge of these gluon distributions helps to get better predictions.

A good way to determine TMD gluon distributions is to study quarkonium production in high energy proton collisions. Considering different processes allows to extract various, complementary informations. The features of TMD factorisation extend the phenomenology, adding new azimuthal modulations, but also azimuthally-independent terms to the differential cross-section. We may be able to detect these effects in data of big experiments such as LHC. Their measure would give us estimates of the gluon distributions inside protons at high energies.

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Presenter: Mr SCARPA, Florent (IPN Orsay - Paris-Sud U. - CNRS/IN2P3)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **82** Type: **Poster**

MAPSSIC: Development of a miniaturized CMOS telemetric probe for deep brain imaging of radiotracers in awake and freely moving animals

Wednesday, May 11, 2016 2:30 PM (20 minutes)

The purpose of MAPSSIC project is to provide an innovative tool for imaging beta+ radiopharmaceuticals in rodents brain, in order to assess brain functional processes. Complementary to others imaging modalities (such as Positron Emission Tomography), MAPSSIC distinguishes itself by performing real time images on awake and fully freely-moving animals, a requirement for concomitant behavioral studies.

Although previous intracerebral probes development showed promising results for behavioral neuroimaging [1,2], limits were reached in sensitivity, noise and mechanical properties. The CMOS sensor technology is an opportunity to provide several advantages for direct detection of beta+ particles.
Thus, the MAPSSIC collaboration aims to produce this solution on the basis of a wide range of expertises, from micro-electronics to behavioral neurosciences. The ambition of the project is to investigate the potential of CMOS active pixels and to develop within a period of 3 years an improved beta+ intracerebral probe surgically implantable in brain tissues.

In order to produce optimal detection technology, three different CMOS sensor prototypes have been designed at Institut Pluridisciplinaire Hubert Curien, probe performance have been studied using Monte-Carlo simulations at Imagerie et Modelisation en Neurobiologie et Cancérologie laboratory, data acquisition and transmission technologies have been studied at Centre de physique des particules de Marseille.

[1]: Märk, J., Benoît, D., Balasse, L., et al. *A wireless beta-microprobe based on pixelated silicon for in vivo brain studies in freely moving rats.* Physics in medicine and biology, 2013, vol. 58, no 13, p. 4483.

[2]: Balasse, L. et al. *PIXSIC: A Wireless Intracerebral Radiosensitive Probe in Freely Moving Rats* Molecular Imaging, Vol 14 (September 2015): pp 484-489.

Authors: Mr AMMOUR, Luis (Université Paris-Sud - IMNC); Dr VERDIER, Marc-Antoine (IMNC); Dr LANIECE, philippe (UMR8165 IMNC)

Presenter: Mr AMMOUR, Luis (Université Paris-Sud - IMNC)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **83** Type: **Oral Presentation**

Development of a Dynamic Reference Electrode for redox potential measurements in fluoride molten salt.

Monday, May 9, 2016 6:00 PM (15 minutes)

The molten salt fast reactor (MSFR) is an innovating concept of the molten salt reactor (MSR) developed by CNRS (France) since 2004. This reactor is designed for the use of a liquid nuclear adapted to work under Thorium fuel cycle (Th232-U233). The nuclear fuel retained for the MSFR will be composed for the fluoride molten salt mixture, LiF-ThF4-(UF4-UF3) (77–19–4) mol%. A current subject in the development of the MSFR is related to the structural materials corrosion, prevention and mitigation. The development of methods for the corrosion prevention is the most important way to avoid the chemical damage.

It has been demonstrated that corrosion directly depends on the redox potential of the salt and the redox potential depends on the ratio [UF4/UF3], this ratio being controlled by addition of metallic uranium which reacts with UF4 to produce UF3. Therefore the control of the redox potential can be used for the materials oxidation prevention. The redox potential has to be measured in situ in the reactor core since the potential of the fuel salt increases with the operation time due to the continuous fission reaction. Several reference electrodes have been studied to reach stable and accurate measurements of the redox potential in the fuel salt. However, these references are made of (glass or ceramic) tubes filled with the fluoride molten salt containing a redox system. The use of glass or ceramic is not secured for the MSFR. Therefore the fuel salt redox potential control within the reactor core requires the development of a metallic reference electrode.

The work of the second year of PhD is focused to the evaluation of the performance of the dynamic reference electrode (DRE) in LiF-ThF4-(UF4/UF3) molten salt system. Firstly, the system was developed in an inactive molten salt. Then, our study was focused on the active molten salt. Redox potential measurements are obtained by the in situ generation of the Th4+/Th redox system on tungsten electrode. The preliminary results of DRE have yielded good results. A good correlation of redox potential with the logarithmic uranium molar fraction is obtained for UFx/U system in LiF-ThF4-(UF4/UF3) molten salt at 650 ℃.

Author: Ms DURAN-KLIE, Gabriela (IPNO)

Presenter: Ms DURAN-KLIE, Gabriela (IPNO)

Session Classification: Nuclear reactors and medical physics

Track Classification: Nuclear Physics

Contribution ID: **84** Type: **Poster**

Study of New ADVACAM Active Edge Sensor Technology for ATLAS Inner Detector Upgrade

Monday, May 9, 2016 3:30 PM (1 hour)

Active edge planar pixel sensors are promising candidates to instrument the inner layers of the new ATLAS pixel detector for HL-LHC, thanks to its radiation tolerant properties and the increased fraction of active area due to a distance as low as 50 μm between the last pixel implants and the activated edge . This poster addresses the study of the electrical characterization of active edge n-in-p planar sensors, fabricated by ADVACAM. The study is mainly aimed to compare different designs and different thicknesses, both with two different UBMs, by investigating the operational breakdown and the full depletion voltage in order to verify the electrical performance of the different configuration of the sensors . The results of these measurements will be discussed. Moreover, TCAD simulation results that help us to understand the performance of these sensors will be shown.

Author: Mrs RASHID, Tasneem (Laboratoire de l'Accelerateur Linéaire (LAL) - Université Paris Sud XI)

Co-authors: Dr LOUNIS, ABDENOUR (LAL-CNRS); NELLIST, Clara (LAL-Orsay); GKOUGKOUSIS, Evangelos -Leonidas (Etudiant Doctoral - LAL - Paris SUD XI)

Presenter: Mrs RASHID, Tasneem (Laboratoire de l'Accelerateur Linéaire (LAL) - Université Paris Sud XI)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **86** Type: **Poster**

Gravitational instability in self gravitating filamentary structures

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Cosmological numerical simulations suggest that the Universe has a web-like structure, the nodes of which are galaxy clusters. These clusters are supplied with matter by gas flowing along the filaments interconnecting them. Part of this accretion occurs intermittently, which indicates that dense clumps of matter do not only form inside clusters themselves, but also either in voids, walls and/or filaments.

Here we investigate the possibility that these clumps formed inside filaments, through gravitational instability. We perform a normal mode analysis and derive both general instability criteria and dispersion relations, to predict under which conditions and in which areas inside the filaments such clumps may form, and also predict their typical size and growth rate.

Authors: Mr DURRIVE, Jean-Baptiste (Institut d'Astrophysique Spatiale); Dr LANGER, Mathieu (Institut d'Astrophysique Spatiale)

Presenter: Mr DURRIVE, Jean-Baptiste (Institut d'Astrophysique Spatiale)

Session Classification: Poster session

Track Classification: Cosmology & Astroparticles

Contribution ID: **87** Type: **Poster**

Évolutions structurales induites par faisceaux d'ions dans des couches minces épitaxiées d'oxydes de terres rares

Wednesday, May 11, 2016 2:30 PM (20 minutes)

Mon travail de thèse concerne l'étude de l'évolution structurale sous faisceaux d'ions d'oxydes de terres rares binaires de structure cubique. L'objectif est double. Premièrement, mettre en évidence les changements structuraux intervenant dans ces conditions hors équilibre et en comprendre l'origine, en vue de l'utilisation de ces matériaux dans le domaine de l'énergie nucléaire. Deuxièmement, initier un changement de structure contrôlé en faisant varier la fluence et/ou l' énergie des faisceaux d'ions pour modifier les propriétés électrique de ces matériaux. La spectrométrie de rétrodiffusion Rutherford en canalisation (RBS/C), la diffraction X (DRX) sous différentes géométries et la spectroscopie Raman ont été utilisées pour caractériser les échantillons vierges et irradiés.
La première partie de la thèse concerne l'étude de couches minces épitaxiées (sur Si) de 380 nm d' épaisseur de l'oxyde de gadolinium (Gd2O3) irradiées avec des ions Au2+ de 4 MeV jusqu'à une fluence de 1016 Au.cm-2. Les données expérimentales de RBS/C ont été simulées à l'aide d'un code Monte Carlo afin, d'obtenir les profils en profondeur du niveau de désordre pour chaque fluences d'ions. L'endommagement augmente significativement en surface. À l'arrière de cette couche fortement modifiée, une zone quasiment exempte de défauts est observée. Suit une zone interfaciale entre Gd2O3 et Si qui apparaît relativement perturbée. La spectroscopie Raman indique que la phase cubique disparaît progressivement avec l'augmentation de la fluence d'ion selon un processus en deux étapes dont l'origine reste à être identifiée. Les mesures de DRX en géométrie asymétrique montrent l'apparition d'une phase monoclinique en surface. La phase monoclinique, non stable thermodynamiquement dans les conditions ambiantes, est stabilisée sur une épaisseur contrôlable grâce à la fluence d'ions. La cinétique d'apparition de cette phase montre un processus en deux étapes.
Dans la deuxième partie de ma thèse, j'ai testé l'influence des effets mécaniques induits par le substrat sur la réponse des couches minces. Dans ce but, des irradiations à une énergie plus basse ont été réalisées (Au+ de 1 MeV) afin de ne pas affecter le substrat. J'ai également comparé différentes épaisseurs de couches minces Gd2O3 (400 nm et 130 nm) pour mettre en lumière d'éventuels effets de surface et d'interface sur les cinétiques de transformation de phase. Enfin, j'ai effectué des irradiations dans les mêmes conditions sur deux oxydes de terres rares Gd2O3 et Er2O3, sachant que le premier est stable sous forme monoclinique à température ambiante et que le second n'existe que sous forme cubique (sauf à très haute température). L'objectif est de corréler les éventuelles transformations structurales induites par faisceaux d'ions et les diagrammes de phase à l'équilibre de cette famille d'oxyde.

Authors: Dr DEBELLE, Aurelien (CSNSM); Ms MEJAI, najah (CSNSM)

Presenter: Ms MEJAI, najah (CSNSM)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **88** Type: **Poster**

Laser frequency stabilization using folded cavity and mirror reflectivity tuning

Monday, May 9, 2016 3:30 PM (1 hour)

A new method of laser frequency stabilization using polarization property of an optical cavity is proposed. In a standard Fabry–Perot cavity, the coating layers thickness of cavity mirrors is calculated to obtain the same phase shift for s- and p wave but a slight detuning from the nominal thickness can produce s- and p wave phase detuning. As a result, each wave accumulates a different round-trip phase shift and resonates at a different frequency. Using this polarization property, an error signal is generated by a simple setup consisting of a quarter wave-plate rotated at 45°, a polarizing beam splitter and two
photodiodes.This method exhibits similar error signal as the Pound–Drever–Hall technique but without need for any frequency modulation. Lock theory and experimental results are presented in this poster.

Author: Mr LIU, Xing (LAL)

Co-author: Mr FAVIER, Pierre (Laboratoire de l'Accelerateur Lineaire)

Presenter: Mr LIU, Xing (LAL)

Session Classification: Poster session

Track Classification: Accelerator Physics

Contribution ID: **89** Type: **Oral Presentation**

Studies for LHAASO-WFCTA and AUGER-Upgrade-SSD

Tuesday, May 10, 2016 4:15 PM (15 minutes)

The LHAASO (Large High Altitude Air Shower Observatory) project is a cosmic-ray observatory under constructing in China. WFCTA (Wide Field of View Cherenkov Telescope Array) is a important module in the LHAASO hybrid detection. This thesis work concertracte on the simulation and event reconstruction of WFCTA when it's working with other modules in LHAASO. This talk will show some preliminary results of single WFCTA telescope simulation. Besides the work for LHAASO, some R&D experimental works for Auger-Upgrade-SSD (scintillator surface detector) will also be mentioned as a second part of thesis work.

Author: Mr ZONG, Zizhao (IPN-Orsay)

Presenter: Mr ZONG, Zizhao (IPN-Orsay)

Session Classification: Cosmology and astroparticles

Track Classification: Cosmology & Astroparticles

Contribution ID: **90** Type: **not specified**

Water/Scintillator cross section ratio for CCQE interactions using ND280 near detector of T2K experiment

Wednesday, May 11, 2016 4:45 PM (15 minutes)

T2K experiment is a long-baseline neutrino oscillation experiment in Japan, muon (anti-)neutrino beam is produced at J-PARC in Tokai and detected then 295 km away at the Super-Kamiokande (SK), a water cherenkov far detector in Kamioka. T2K main puropose is to observe electronic (anti-)neutrino appareance and muonic (anti-)neutrino disappereace, oscillation parameters are determined then by comparing the neutrino interactions observed at the near and far detectors. T2K includes also two near detectors placed at 280 meters downstream from (anti-)neutrino production point, an on-axis detector, INGRID and an off-axis detector ND280 used to measure (anti-)neutrino-nucleus charged currect interactions (CC). The observed CC interactions are then used to constraint neutrino oscillation parameters. T2K flux peaks at 600 MeV so CC quasi-elastic (CCQE) interactions dominate the total cross-section, understanding this channel is thus crucial for a precision measurements. The cross-section of neutrino CCQE-like interactions in water is measured with the near detector ND280 of the T2K experiment. ND280 tracker system is composed of 3 Time Projection Chamber (TPCs) interleaved with 2 Fine Grained Detectors FGD1 and FGD2 installed inside a 0.2 T dipole magnet. The FGD2 consists of polystyrene scintillator bars interleaved with water passive layers. This analysis uses T2K data Run I-IV to extract the ratio between CCQE-like interactions that took place in water and scintillators in the FGD2 sub-detector as a function of neutrino reconstructed energy and muon kinematic parameters.

Author: Mr GIZZARELLI, Francesco (CEA Saclay)

Presenter: Mr GIZZARELLI, Francesco (CEA Saclay)

Session Classification: High-energy physics

Track Classification: Particle Physics

Contribution ID: **91** Type: **Oral Presentation**

Studying $\rho - N$ couplings with HADES in pion-induced reactions

Wednesday, May 11, 2016 10:45 AM (15 minutes)

The High-Acceptance Di-Electron Spectrometer (HADES) operates at the GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt with pion, proton and heavy-ion beams provided by the synchrotron SIS18. HADES results on e^+e^- production in proton-nucleus reactions and in nucleus-nucleus collisions demonstrate a strong enhancement of the dilepton yield relative to a reference spectrum obtained from elementary nucleon-nucleon reactions. These observations point to a strong modification of the in-medium rho spectral function driven by the coupling of the ρ to baryon-resonance hole states. However, to scrutinize this conjecture, a precise study of the electromagnetic baryon-resonance transition form factors in the time-like region is mandatory.
A promising approach are reactions of the type $^-N \longrightarrow R \longrightarrow e^+ e^- N$, for which no experimental data exist yet. In summer 2014, HADES took data using pion beam on carbon and polyethylene targets. A large part of the data was taken at a pion beam momentum of 0.69 GeV/c in order to explore the second resonance region and the sub-threshold coupling of the ρ to baryonic resonances. In this talk the preliminary results of inclusive dilepton production and for the exclusive channel $^-p \longrightarrow e^+ e^- n$ will be presented and compared with different model calculations. The necessity of introducing VMD will be pointed out as well as the possibility to get some hints about the resonance contributions using angular distributions of dileptons.

Author: Mr SCOZZI, Federico (IPN Orsay)

Presenter: Mr SCOZZI, Federico (IPN Orsay)

Session Classification: Hadronic physics

Track Classification: Nuclear Physics

Contribution ID: **92** Type: **Oral Presentation**

Analog and digital signal processing in the liquid argon calorimeter trigger system of ATLAS detector in the High-Luminosity LHC

Wednesday, May 11, 2016 9:45 AM (15 minutes)

The forthcoming high-luminosity environment of the Large Hadron Collider (LHC) implies the redesign of several subsystems in the ATLAS detector. In particular, an improvement of the calorimeter trigger system has to be done to match the data acquisition rate with the expected increase of the collisions rate. The strategy is to increase the calorimeter spatial resolution and to use the longitudinal shape information of the energy deposits to better identify electromagnetic particles, and so, enhance the efficiency of the triggers. The aim of our work is to study the performances of one of the most essential parts of the calorimeter trigger upgrade: the Liquid Argon Trigger Digitizer Board (LTDB), which will digitize the signals coming from the calorimeter at very high precision and will transmit them to the energy real-time calculators. We are currently designing precision instrumentation boards that will allow us to test in depth the analog stages, and also exercise digital conversion part as well as in the data serialization and data transmission. Furthermore, we are analyzing physics data taken during LHC Run 2 last year with a LTDB demonstrator installed on the detector. These analyses allow to understand analog signals properties and actual board performance.

Authors: Mr ZONCA, Eric (CEA); Mr DESCHAMPS, Hervé (CEA); Ms PACHECO RODRIGUEZ, Laura (CEA); Mr SCHWEMLING, Philippe (CEA)

Presenter: Ms PACHECO RODRIGUEZ, Laura (CEA)

Session Classification: Accelerator physics

Track Classification: Accelerator Physics

Contribution ID: **93** Type: **Poster**

Looking for dark matter: from the earth to the Sky

Tuesday, May 10, 2016 10:15 AM (20 minutes)

For more than 80 years ago, the existence of a "dark" component in our Universe was proposed regarding astrophysical observations. Since that time, several other hints (rotation curves of the galaxies, bullet-cluster, measurement of the Cosmological Microwave Background) came to confirm this hypothesis. However, the situation seems today even less clear than ever. This is the consequence of the recent explosion in the field of experimental data accessible in this international race between the space (FERMI, AMS, PLANCK, XCHANDRA) and the ground (IceCube, HESS, LUX, EDELWEISS, XENON, PANDAX), between continents (China decided recently that dark matter searches is a national priority at the same level that an next generation collider) and between models (from the milli-electronvolt axion to the multi-Peraelectronvolt WIMPZILLA). In the same manner, we also know that the Standard Model of Particle Physics is incomplete (neutrino mass, unification of gauge couplings, lepto/baryogenesis, instability of Higgs potential at an intermediate scale). Indeed, at a time where the LHC will furnish a lot of new data from 2015 till 2018, its center of mass energy will go beyond 10 TeV. It is nowadays not possible anymore to remain ourselves in the effective context, as the Fermi theory was valid only below the electroweak energy scale. As the presence of the W+ boson implies a considerable sum of consequences that an effective low energy model is unable to explain, a dark matter model taking into account theoretical considerations as obvious as renormalizability or dynamical breaking of symmetry, implies non-trivial consequences at low energy. The aim of the present thesis is to insert possible answers to the dark matter problem within cosmological scenarios in the framework of coherent quantum field theories valid up to the Planck scale. This will be made by deducing specific phenomenological signatures of dark matter particles in reasonable extensions of the Standard Model and comparing them to the experimental data.

Authors: Ms DUTRA, Maíra (Laboratoire de Physique Théorique d'Orsay); Dr MAMBRINI, Yann (Laboratoire de Physique Théorique d'Orsay)

Presenter: Ms DUTRA, Maíra (Laboratoire de Physique Théorique d'Orsay)

Session Classification: Poster session

Track Classification: Cosmology & Astroparticles

Contribution ID: **94** Type: **Oral Presentation**

Measurement of charge exchange cross sections between positronium, proton and hydrogen

Tuesday, May 10, 2016 12:15 PM (15 minutes)

The GBAR experiment will measure the free fall of antihydrogen to test the weak equivalence principle with antimatter. In order to produce this atom with a velocity of the order of 1 m/s, we will use an intermediate state, the H^+ ion, composed of an antiproton and two positrons. This ion can be slowed to such velocities and then neutralized by photo-detachment of the excess positron. Its production is foreseen through two successive reactions: $\bar{p}$ + Ps $\rightarrow \bar{H}$ + e^- and $\bar{H}$ + Ps $\rightarrow \bar{H}^+$ + e^-, where Ps stands for positronium: a bound state of an electron and a positron. During my thesis I'll measure the cross section of the reactions that are charge conjugate of the above, i.e. where the antiproton is replaced by a proton, with production of hydrogen and of the H^- ion. For that we use the positron source of Irfu at CEA Saclay, based on a small electron linac; a buffer gas trap and a multi-electrode Penning-Malmberg trap, with a 5 T magnetic field, to cool and trap the positrons; an SiO_2 target that produces a Ps cloud when bombarded with positrons; and a proton gun. This apparatus will later be moved to CERN where the antimatter reaction will be studied with a more powerful linac and a source of antiprotons.

Author: Ms MAIA LEITE, Amelia (Cea Saclay)

Presenter: Ms MAIA LEITE, Amelia (Cea Saclay)

Session Classification: Beyond standard model

Track Classification: Particle Physics

Contribution ID: **95** Type: **Poster**

3D printing of anthropomorphic phantoms and validation of their usefulness in internal dosimetry

Wednesday, May 11, 2016 2:30 PM (20 minutes)

In vivo counting is a monitoring method used to estimate the incorporation of radionuclides from spectrometric measurements. In practice, the calibration is performed using physical phantoms which are currently limited as compared with the human anatomy. Many researches are focused on the development of realistic calibrations using numerical phantoms and Monte Carlo simulations. Nowadays, the development of 3D printing makes it possible to design realistic calibration phantoms to improve measurements.

In case of nuclear accident, all iodine's isotopes are released into the atmosphere and are naturally retained in the thyroid. The exposed population risks developing thyroid cancer and this risk is greater for children, because of their higher radiosensitivity. Several incidents have shown the difficulty of interpreting thyroid measurements in children. Indeed, because there is no thyroid phantom adapted for children, the calibration is currently carried out with an adult thyroid phantom.

To obtain a better estimate of children health risk, thyroid anthropomorphic phantoms were designed for different ages (5, 10, 15, and adult man), using a CAD (computer aided design) software. Necks, vertebrae, spinal cords and tracheas were also designed according to age and put together to create the final phantoms. An important part of the work was to optimize the manufacturing of the insert, particularly to mimic a realistic attenuation of radiation and to ensure the waterproofness and robustness over time. Ultimately the thyroid phantoms were filled with radioactive solution (133Ba) and sealed.

Counting efficiencies for all phantoms, in contact with the detector were measured: a 25% difference between the 5 years old child and the adult was observed. The comparison of the counting efficiencies between the IRSN reference phantom and the developed adult phantom showed a mean difference of about 7%. The developed phantoms were thus validated and patented (FR1650855).

Then, a systematic study should be conducted to define the most appropriate protocol for measuring children thyroid in post-accident situation. These phantoms will also be used in nuclear medicine to improve the dose assessments and to personalize the injected activity.

Author: Ms BEAUMONT, Tiffany (IRSN)

Co-authors: Dr BROGGIO, David (IRSN); Dr FRANCK, Didier (IRSN)

Presenter: Ms BEAUMONT, Tiffany (IRSN)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **96** Type: **Poster**

Re-opening dark matter windows compatible with a diphoton excess

Monday, May 9, 2016 3:30 PM (20 minutes)

We investigate a simple setup in which an excess in the di-photon invariant mass distribution around 750 GeV, as seen by the ATLAS and CMS collaborations, is originated through a pair of collimated photon pairs. In this framework a scalar state s decays into two light pseudo-Goldstone bosons a, each of which subsequently decays into a pair of collimated photons which are misidentified as a single photon. In a minimal context of spontaneous symmetry breaking, we show that coupling a complex scalar field $\Phi = (s + ia)/\sqrt{2}$ to a fermionic dark matter candidate χ, also responsible for generating its mass, allows for the correct relic density in a large region of the parameter space, while not being excluded by the direct or indirect detection experiments. Moreover, the correct relic abundance can naturally co-exist with a relatively large width for the resonant field s.

Author: Mr PIERRE, Mathias (LPT Orsay)

Presenter: Mr PIERRE, Mathias (LPT Orsay)

Session Classification: Poster session

Track Classification: Cosmology & Astroparticles

Contribution ID: **97** Type: **Oral Presentation**

Search for the Standard Model Higgs boson decaying into bb and produced in association with a top quark pair in the ATLAS experiment

Monday, May 9, 2016 2:30 PM (15 minutes)

I am a 2nd year PhD student working in the ATLAS experiment at Cern. In this collaboration, I mainly contributed to the identification of b-jets. I optimized the reconstruction of secondary vertices at high jet momentum, improved the recognition of B-hadron vertices against V0 vertices, and brought some corrections to a Boosted Decision Tree algorithm (that combines b-tagging informations into one single discriminant variable), leading to a significant improvement of physics performances.
Since the begining of 2016, I have been involved in the search for the 'Higgs boson, top and antitop quarks' final state in the regime where the three particles are produced at high momenta. I compared the 13 TeV proton-proton collisions recorded in 2015 with the predictions, and optimized the selection. I am also working on detector operations, with the responsability to maintain an efficient data recording.

Author: Mr LE QUILLEUC, Eloi (CEA IRFU/SPP)

Presenter: Mr LE QUILLEUC, Eloi (CEA IRFU/SPP)

Session Classification: High-energy physics

Track Classification: Particle Physics

Contribution ID: **98** Type: **Oral Presentation**

Measurement of the Z-boson production in p-Pb collisions at the LHC with ALICE

Wednesday, May 11, 2016 11:30 AM (15 minutes)

In ultra-relativistic heavy-ion collisions, the formation of a hot and dense strongly-interacting medium, a Quark-Gluon Plasma (QGP), is expected. To characterize the QGP, one must disentangle genuine QGP effects from the ones due to the nuclear medium presence known as Cold Nuclear Matter (CNM) effects. One of the important CNM effects is the modification of the parton distribution function in the nucleus (nPDF) with respect to the nucleon one (PDF). In hadronic collisions, the production of the Z-boson is dominated by the quark anti-quark annihilation process. Due to the large Z-boson mass, those quarks are probably a valence (u or d) quark and a corresponding anti-quark from the sea. Hence, the measurement of the Z-boson production in proton-nucleus or nucleus-nucleus collisions can constrain the corresponding nPDF.

The Z-boson production is measured with ALICE in p-Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV. Z-boson candidates are reconstructed from pairs of opposite sign muons with transverse momenta larger than 20 GeV/c.\\% and $-4 < \eta < -2.5$.
The Z-boson production cross section will be presented in the forward (p-going direction) and backward (Pb-going direction) center-of-mass rapidity regions, corresponding to $2.03 < y_{\rm cms} < 3.53$ and $-4.46 < y_{\rm cms} < -2.96$, respectively. The results will be compared to the measurement from the LHCb experiment and to theoretical calculations from different theoretical models.

Author: Mr TARHINI, Mohamad (IPN Orsay)

Presenter: Mr TARHINI, Mohamad (IPN Orsay)

Session Classification: Hadronic physics

Track Classification: Nuclear Physics

Contribution ID: **99** Type: **Oral Presentation**

Development of an optical resonator for the ThomX X-ray source

Wednesday, May 11, 2016 9:30 AM (15 minutes)

Inverse Compton Scattering provides a unique way to produce quasi-monochromatic X-rays via the interaction of relativistic electrons with a laser pulse. This process has the advantage of producing a very high flux of X-rays with energies above a few tens of keV for a modest electron beam energy. In addition the output beam divergence is much larger than in classical synchrotron light sources and the X-ray beam is thus easier to manipulate. We present an X-ray source under construction at Paris-Sud University, ThomX. This source has a small footprint of 70m² compared to synchrotron light sources and uses a 50 MeV electron beam that collides at 16.7 MHz with a few picosecond pulsed laser beam which power is enhanced at the state of the art. In the nominal design the enhanced average laser-beam power is 600 kW and X-rays between 30 and 50 keV are produced with a flux of 1013 photons per second. This energy range as well as the energy-angular dependence due to the Compton back-scattering process are suitable for societal applications like radiotherapy or art history.
We use a prototype cavity to perform R&D for the ThomX source. Various diagnostics like real time finesse measurements or active coupling enhancement are under study on this test cavity to increase the achievable stored power. We will present the ongoing developments along with the results we obtained. A very high finesse optical cavity (F > 28 000) is used, which is one of the highest finesse cavities in pulsed regime. The numerous challenges and solutions to mitigate the related issues will be presented.

Author: Mr FAVIER, Pierre (Laboratoire de l'Accelerateur Lineaire)

Presenter: Mr FAVIER, Pierre (Laboratoire de l'Accelerateur Lineaire)

Session Classification: Accelerator physics

Track Classification: Accelerator Physics

Contribution ID: **100** Type: **Oral Presentation**

Gamma-spectroscopy of neutron-rich ^{79}Cu through proton knock-out

Tuesday, May 10, 2016 2:15 PM (15 minutes)

One of the challenges nowadays in nuclear physics is to study nuclei as far as possible from stability. In these so-called exotic regions, the nuclear structure is strongly evolving. As a consequence, the "classical"magic numbers (8, 20, 28, 50, 82, 126) are not universal over the nuclear chart and unexpected behaviors may appear for extreme N/Z ratio.

This presentation focuses on the exotic region of ^{78}Ni, presumed to be doubly magic ($Z = 28$, $N = 50$), and more specifically on the $Z = 28$ shell gap to see whether it weakens when adding neutrons beyond $N = 40$. This is done through the study of copper isotopes (core of nickel + 1 proton). We focus here on neutron-rich ^{79}Cu, produced through proton knock-out at RIKEN in Japan.

Author: OLIVIER, Louis (IPN Orsay)

Presenter: OLIVIER, Louis (IPN Orsay)

Session Classification: Nuclear physics

Track Classification: Nuclear Physics

Contribution ID: **101** Type: **not specified**

Study of Top quark production at ILC and optimization of Particle Flow algorithms with machine learning techniques

Wednesday, May 11, 2016 4:30 PM (15 minutes)

A simple track-finding algorithm was developed to study tracks left by secondary particles, emerging from hadronic interactions in a highly granular electromagnetic calorimeter prototype. The predictions of two Monte Carlo Geant4 models are compared with experimental data, taken at FNAL in 2008, using a novel track-finding algorithm. Present Monte Carlo simulations provide a goodenter code here description of the experimental data in terms of new observables, available through the detailed analysis of the secondary particles; the Monte Carlo predictions are within 20% of the data, and for many observables much closer. Main systematic effects were studied using electron and muon samples.

The top quark production study is concentrated on improving of top quark polar angle reconstruction in ILD simulation. A charge information of the top quark is extracted from a corresponding b-jet by using two techniques: secondary vertex charge calculation and usage of kaon charge from ternary vertex; The secondary vertex charge technique is enhanced by a new vertex charge recovery method. The kaon identification can be done by using a dE/dx particle classification in TPC of ILD. Combination of these two methods gives ˜95% of top quark charge reconstruction purity.

Author: Mr BILOKIN, Sviatoslav (Laboratoire de l'Accélérateur Linéaire)

Presenter: Mr BILOKIN, Sviatoslav (Laboratoire de l'Accélérateur Linéaire)

Session Classification: High-energy physics

Track Classification: Particle Physics

Contribution ID: **102** Type: **Oral Presentation**

The photon polarisation in radiative B decay.

Monday, May 9, 2016 2:45 PM (15 minutes)

In rare B mesons decay such as $b \to s\gamma$, standard model predictions indicate that the photon should be mostly left-handed. And since the GIM mechanism allows this process to only occurs through loops, measurements of the photon polarisation can provide a good test of the standard model. Indeed, if new physics heavy particles contribute to the process the photon polarisation may change. Unfortunately the photon helicity cannot be directly measured, but this difficulty may be overcome through the determination of the polarisation of the s-quark. I will present a method, requiring three hadrons in the final state, which using angular analysis can give us information on the s-quark polarisation. We will mainly focus on the decay $B \to K\pi\pi\gamma$ due to its relatively large branching ratio.

Author: Mr HEBINGER, jeremy (lal)

Presenter: Mr HEBINGER, jeremy (lal)

Session Classification: High-energy physics

Track Classification: Particle Physics

Contribution ID: **103** Type: **Oral Presentation**

Research of supersymmetry with the ATLAS detector

Tuesday, May 10, 2016 12:30 PM (15 minutes)

The supersymmetry is one of the most studied theory beyond the standard model. During the presentation, I will describe the research of supersymmetry (squarks and gluinos) with the ATLAS detector in the 0 lepton channel.

Author: Mr ABELOOS, Baptiste (LAL)

Presenter: Mr ABELOOS, Baptiste (LAL)

Session Classification: Beyond standard model

Track Classification: Particle Physics

Contribution ID: **104** Type: **Poster**

Detailed data-MC studies for the Electromagnetic Calorimeter of the CMS experiment at LHC.

Wednesday, May 11, 2016 2:30 PM (20 minutes)

Detailed studies on data at 0T in order to understand the CMS Electromagnetic Calorimenter performances during data taking at 0T of the Run2 of LHC will be presented, together with their comparison with data at 3.8T of Run2.
Also data-MC comparisons in order to understand the remaining data-MC discrepancies at 3.8T will be shown.

Author: NEGRO, Giulia (CEA-Saclay Irfu/SPP)

Presenter: NEGRO, Giulia (CEA-Saclay Irfu/SPP)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **105** Type: **Oral Presentation**

Measurement of Higgs boson couplings in the diphoton decay channel with the ATLAS experiment

Monday, May 9, 2016 3:15 PM (15 minutes)

The run 2 of the LHC starts an era of precision measurement in the Higgs sector which may be a portal to Beyond Standard Model physics.
To be sensitive to BSM, an improvement of the systematics is necessary.
The final step of the electron energy correction, which is part of the dominant experimental uncertainties, uses a data driven technique to calibrate the energy of electrons using Z decay.
Run 2 prerecommandations were derived using reprocessed 8TeV data and early recommandations were computed with the first 13TeV data.
Coupling are measured using a likelihood procedure on the data.
30% precision was achieved in run 1 and a sensitivity study is ongoing for run 2.

Author: Mr GOUDET, Christophe (LAL)

Presenter: Mr GOUDET, Christophe (LAL)

Session Classification: High-energy physics

Track Classification: Particle Physics

Contribution ID: **106** Type: **Oral Presentation**

Standalone track reconstruction for the LHCb upgrade scintillating fibre tracker and study of double charm B decays at LHCb.

Monday, May 9, 2016 3:00 PM (15 minutes)

The project of the LHCb upgraded detector foresees the presence of a scintillating fiber tracker (SciFi) for the LHC run III starting in 2020. We will describe the design and the performances of the newly developed algorithm used for the reconstruction of stand-alone tracks in the SciFi, called Hybrid Seeding.

The B mesons double charm decays have been introduced to explain the discrepancy observed between semi-leptonic branching ratio decays and the number of charmed mesons produced in B decays. Nowadays, there are some of the double charm decay modes which have not been observed and $B^0 \to D^0\overline{D}^0 K^{*0}$ is one of them. This decay channel can improve our understanding on multi-body B hadrons decays containing multiple charmed final states. Furthermore, it allows to perform searches of exotic mesons looking to the $D^0\overline{D}^0$ system invariant mass spectrum. An overview of the analysis work done for will be presented.

Author: Mr QUAGLIANI, Renato (LAL Orsay and Bristol University)

Presenter: Mr QUAGLIANI, Renato (LAL Orsay and Bristol University)

Session Classification: High-energy physics

Track Classification: Particle Physics

Contribution ID: **107** Type: **Poster**

Search for the Higgs boson decaying into b-quarks in the ATLAS experiment.

Wednesday, May 11, 2016 2:30 PM (20 minutes)

In July 2012, the ATLAS and CMS experiments at the LHC reported the observation of a new particle with a mass about 125 GeV and properties consistent with that expected for the Higgs boson in the Standard Model. Especially, the SM Higgs boson decay channel H->bb is predicted to have a branching ratio about 57% for mH = 125 GeV. Hence, its observation is crucial in order to access to the Higgs boson's properties such as its overall decay width. The work I will perform during my PhD thesis shall focus on the search for the Higgs boson in associated production, i.e. emitted by a weak interaction gauge boson, in events containing 2 b-quarks and no lepton in the final state. The prospects for this search consists of the use of Boosted Decision Trees, which are efficient tools in order to take advantage of the correlation of final-state variables for signal events, and use these properties in order to disciminate H->bb events from backgrounds events with similar final-states.

Author: Mr DELPORTE, Charles (LAL)

Presenter: Mr DELPORTE, Charles (LAL)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **108** Type: **Poster**

Probing the evolution of nuclear structure thanks to high accuracy mass measurements with ISOLTRAP at CERN/ISOLDE.

Monday, May 9, 2016 3:30 PM (1 hour)

Due to the inherent relationship with the binding energy, nuclear masses hold a fingerprint of the interactions taking place within a given nucleus. Small as it is, about one percent of the total mass of the system, the binding energy can give precious information on such phenomena as nuclear shell effects and deformation, especially on the way they evolve far from stability.

The introduction of Penning traps into the field of mass spectrometry has made this method a prime choice for high-accuracy measurements on stable and short-lived nuclides. Over the last three decades, the continuous development of ion trapping techniques has constantly pushed forward the limit of what is achievable, in terms of precision and resolving power, such that the ever more demanding experimental conditions can be handled.

A very recent experimental program dedicated to the mass measurement of exotic Chromium isotopes has been undertaken with the pioneering Penning trap mass spectrometer ISOLTRAP at ISOLDE (CERN). Refined masses in this region of the nuclear chart are essential to tackle the delicate question of the evolution of nuclear structure towards the so-called second "island of inversion"around N=40. So far, the masses measured in the Chromium chain were too imprecise to undoubtedly address the question of the development of nuclear deformation towards 64Cr where spectroscopy data indicates that, for this given region of the nuclear chart, a maximal quadrupole deformation is reached.

Author: MOUGEOT, Maxime (CSNSM)

Presenter: MOUGEOT, Maxime (CSNSM)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **109** Type: **not specified**

Search for the Higgs boson decaying to two photons and produced in association with a pair of top quarks in the CMS experiment

Wednesday, May 11, 2016 5:00 PM (15 minutes)

A search for the Higgs boson produced in association with a pair of top quarks and its decay to two photons has been performed by the CMS Collaboration at the LHC experiment using pp collisions at a center-of-mass energy of 13TeV with an integrated luminosity of 2.6/fb. This associated production is the only direct access to the top quark Yukawa coupling and decay to two photons has very clean signature in the detector as well as mass resolution ~ 1%. To have a good sensitivity of the analysis it is very important to keep the good diphoton mass resolution, which depends on the photon energy and the angle between two photons.

In the Higgs boson decaying to two photons analysis the vertex indentification algorithm had to be revised for Run II conditions. In the decay of the Higgs boson into two photons, the unconverted final state photons are not detected in the tracker, so the determination of the associated primary vertex is not trivial. Moreover, the CMS electromagnetic calorimeter has no longitudinal segmentation, it is thus not a pointing calorimeter. The information from the recoiling tracks, and, when at least one of the photons is converted into electron-positron pair in the tracker, from the conversion tracks can be used to determine the primary vertex. The algorithm is described in this presentation together with its performance.

Author: Ms KUCHER, Inna (CEA Saclay)

Presenter: Ms KUCHER, Inna (CEA Saclay)

Session Classification: High-energy physics

Track Classification: Particle Physics

Contribution ID: **110** Type: **Poster**

Nature of quantum correlations in many body systems

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Since the 50's the importance of quantum correlations to describe matter has been understood, first in atomic systems by Cooper and Froehlich and extended to Nuclei by Mott and Pines through an intuitive 'pair' models.
In a first part i'll discuss a modern interpretation of this phenomena and some applications.
In a second part I'll focus on more general type of correlations and possible impact on nuclear structure.
I'll then conclude by short insight of the localization properties of correlated structures.

Author: Mr LASSERI, Raphaël-David (IPNO)

Presenter: Mr LASSERI, Raphaël-David (IPNO)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **112** Type: **Poster**

GPD nucleon model from Dyson-Schwinger equations

Monday, May 9, 2016 3:30 PM (1 hour)

The extraction of GPDs (Generalized Parton Distributions, that encode information about the correlation between longitudinal momentum and transverse position of the quarks and gluons inside the hadron) is one of the main challenges of Hadronic Physics nowadays. In parallel, the need to produce accurate models in the valence region (relevant for JLab kinematics for example) is important. The Dyson-Schwinger formalism provides an *ab initio* framework close to QCD that one can use to build *in fine* a model for GPDs. This was done successfully for the pion case, and the goal of this work is to extend it to the nucleon.

Author: Mr CHOUIKA, Nabil (Irfu/SPhN - CEA Saclay)

Presenter: Mr CHOUIKA, Nabil (Irfu/SPhN - CEA Saclay)

Session Classification: Poster session

Track Classification: Particle Physics

Contribution ID: **113** Type: **Oral Presentation**

H.E.S.S. Observations of the giant radio galaxy M87

Tuesday, May 10, 2016 5:15 PM (15 minutes)

The supergiant elliptical galaxy M87 has been first detected at Very High Energies (VHE, E > 0.4 TeV) by the H.E.S.S. telescopes in 2005. M87 has been continuously observed by the VHE instruments, resulting in the detection of three high flux states occurring respectively in 2005, 2008 and 2010. However, the origin and location of the gamma-rays production remains still unresolved. With its vicinity (16.7 Mpc), the relativistic jet inclination (20°) towards the Earth and the supermassive black hole ($M = (3 - 6) \times M_{\odot}$), M87 offers a unique laboratory to study the gamma-ray production and solve the origin of the VHE emission. In this work we present the recent results and an overview of 10 years of observations with the H.E.S.S. telescopes.

Author: Ms ZEFI, Floriana (LLR-Ecole Polytechnique)

Presenter: Ms ZEFI, Floriana (LLR-Ecole Polytechnique)

Session Classification: Cosmology and astroparticles

Track Classification: Cosmology & Astroparticles

Contribution ID: **114** Type: **Oral Presentation**

The new neutron beam of n_TOF at CERN, experiments and physics

Tuesday, May 10, 2016 2:30 PM (15 minutes)

CERN's neutron time-of-flight facility (n_TOF) experimental area 2 (EAR-2), which has been constructed and is operational since 2014, is designed and built as a complementary to experimental area 1 (EAR-1). The parallel plate avalanche counter (PPAC) measurement was performed at EAR-2 on July of 2015. And some basic characteristics of this new beam line, such as beam profile, neutron flux, are obtained.

Author: Mr CHEN, Yonghao (IPNO)

Presenter: Mr CHEN, Yonghao (IPNO)

Session Classification: Nuclear physics

Track Classification: Nuclear Physics

Contribution ID: **115** Type: **Poster**

Study of ultra-high energy cosmic rays with the new observables of composition of the Pierre Auger Observatory

Wednesday, May 11, 2016 2:30 PM (20 minutes)

The Pierre Auger Observatory is today the largest observatory built, with a ground surface of 3000 km², dedicated to the observation of ultra-high energy cosmic rays (>10^18 eV). At these energies we found two structures in the energy spectrum of the cosmic rays (CRs): the ankle (~ 4.10^18 eV) and the GZK cut-off (~5.10^19 eV) which are really interesting to understand the origin of the CRs and their propagation in the Universe. However the origin galactic or extra-galactic of the CRs is still one of their mysteries. To answer these questions we need to know the composition of the CRs. This information is currently given by the fluorescence detector of the observatory but it suffers a very low statistic (efficient at only 10% of its duty cycle). That's why an upgrade of the ground detectors is currently being deployed and tested to measure the electromagnetic and muonic components of the atmospheric showers (produced when the CRs enters in the atmosphere). The aims of my thesis is to reconstruct the events seen by the observatory including these new observables to extract the energy, the mass and the arrival directions of the CRs, then tested different scenarios of the CRs'origin.

Author: LUCE, Quentin (Institut de Physique Nucléaire d'Orsay)

Presenter: LUCE, Quentin (Institut de Physique Nucléaire d'Orsay)

Session Classification: Poster session

Track Classification: Cosmology & Astroparticles

Contribution ID: **116** Type: **Poster**

Particle transport in stochastic media: beyond the Boltzmann equation

Monday, May 9, 2016 3:30 PM (1 hour)

In the context of reactor physics, the simulation of the transport of neutrons and photons (which obeys the Boltzmann equation) is based on deterministic or stochastic methods. The stochastic approach resorts to Monte Carlo codes, such as TRIPOLI-4®. Developed by the CEA, this code is used for criticality, shielding and nuclear instrumentation. In this context, the random walks of the particles are assumed to occur in a perfectly known medium. However, several applications require the simulation of particle trajectories within random media. Examples are widespread and concern, for instance, the evaluation of severe accidents with reactor core melt-down (the so-called corium), the analyis of the impact of the grain size in MOX fuel, the study of neutron diffusion in water-vapour mixtures, or the modeling of double-heterogeneity problems in HTR or pebble-bed reactors. All such problems can be addressed within the framework of stochastic geometries, which allow representing the heterogeneity of the traversed media by assigning probabilities for their physical properties. Isotropic Poisson geometries are particularly relevant for application in reactor physics, but their statistical properties, only partially known, are still the subject of intensive research efforts.

Author: Ms LARMIER, Coline (CEA DEN-DANS)

Presenter: Ms LARMIER, Coline (CEA DEN-DANS)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **117** Type: **Poster**

Design of the Cherenkov Full-body PET Scanner with GATE Simulation

Tuesday, May 10, 2016 10:15 AM (20 minutes)

Positron emission tomography (PET) is a powerful nuclear imaging technique used widely nowadays in oncology, cardiology and neuropsychiatry. The PET technology consists in injecting the patient with a radioactive tracer. The decay of the tracer emits a positron which annihilate with an electron. As a result of the annihilation, two 511 keV gamma quanta are emitted back-to-back and registered by the dedicated detectors.
The individual detector of the proposed scanner consists in the lead fluoride crystal (PbF2) assembled with MCP-PMT. Scanner diameter is 800 mm and axial size is 53 mm. 43 detectors compound in the ring. Crystal size is 6.5 mm x 6.5 mm x 10…20 mm. Matrix consists of 1 x 8 x 8 PbF2 crystals. As the MCP-PMT we envisage to use the
Photonis Planacon detector XP85112. Detector size is 59 mm x 59 mm with an
active area of 53 mm x 53 mm (64 anodes). We will use a modified version of this detector, with the sapphire window. First results show good TOF resolution (140 ps). We will calculate NECR taking into account TOF potential, evaluate gain of the scanner due to the TOF technique, optimize the configuration, image reconstruction for a realistic tracer distribution.

Author: Mrs ALOKHINA, Marharyta (CEA/IRFU/SPP)

Presenter: Mrs ALOKHINA, Marharyta (CEA/IRFU/SPP)

Session Classification: Poster session

Track Classification: Nuclear Physics

Contribution ID: **118** Type: **not specified**

Implementation of a laser ciculator for the production of a high spectral brillance γ source

Monday, May 9, 2016 3:30 PM (20 minutes)

In the context of the R&D program of the EuroGammaS consortium, a collaboration between different academic and industry partners for the Nuclear Physics pillar of the European project Extreme Light Infrastructure (ELI-NP), two multipass γ-ray Compton machines are to be built in Măgurele, Romania with photons of tunable energy between $0.2\,\mathrm{MeV}$ and up to $20\,\mathrm{MeV}$. These machines will have a spectral density an order of magnitude superior to best current machines ($\sim 10^4\,\mathrm{s}^{-1}\cdot\mathrm{eV}^{-1}$ at peak energy).
To achieve the required brilliance, the Gamma beam will be produced from the interaction between a relativistic electron bunch and a train of 32 pulses of a high power laser, both at 100 Hz. The spatial and temporal superimposition of the electron and laser beams is challenging and requires state-of-the-art precision machinery and techniques.
Due to the high number of optics (around 120), the surface defects of the mirrors are yet another key aspect to consider in order to obtain a good quality γ beam.
A prototype of the multi-pass systems is currently under construction and should be finished by the summer of 2016.
The challenges, advances and technical choices in the optical design of the Gamma Beam System will be exposed in this work.

Author: Mr NDIAYE, Cheikh Fall (LAL)

Presenter: Mr NDIAYE, Cheikh Fall (LAL)

Session Classification: Poster session

Track Classification: Accelerator Physics

Contribution ID: **119** Type: **Oral Presentation**

STIL seminars

Tuesday, May 10, 2016 5:40 PM (10 minutes)

Friendly seminars between PhD students of several laboratories of the Orsay campus.

Author: Mr DURRIVE, Jean-Baptiste (Institut d'Astrophysique Spatiale)

Presenter: Mr DURRIVE, Jean-Baptiste (Institut d'Astrophysique Spatiale)

Session Classification: PhD associations

Track Classification: Particle Physics

Contribution ID: **120** Type: **Oral Presentation**

Synapse presentation

Tuesday, May 10, 2016 5:30 PM (10 minutes)

During your PhD thesis, you can do teaching or scientific mediation but do you know that you can also work in a company as a consultant during 32 days maximum?

This kind of doctoral missions in a company are called expertise-consulting missions. They have been created to develop links between the academic research world and the industrial world and to widen the PhD students' job prospects. These missions are both a good chance for PhD students to discover the business world and to develop a network and an opportunity for companies to resort to PhD student's skills to find a cheaper and fitting solution to their problems.

Who to contact for doing an expertise-consulting mission when you are a PhD student from Paris-Saclay? Contact SYNAPSE!

SYNAPSE is an association led by PhD students from PHENIICS who was created in 2015 in order to promote the identification, the attribution and the development of the expertise-consulting missions in Paris-Saclay. Our main goal is to create a database with PhD student's CV profiles on one hand and on the other hand to create a catalogue of missions proposed by companies.

You do no longer have to spend time and energy looking for contacts, wondering which kind of mission you could do in a company, we do it for you! If you are interested, what you have to do is to send us your CV profile at this email adress:

synapse@universite-paris-saclay.fr

We are also looking for manpower, so please join us! There is room for developing new skills and discovering new things in SYNAPSE, do not hesitate, contact us!

The SYNAPSE team

Author: Mrs ZARROUK, Pauline (CEA-Saclay)

Presenter: Mrs ZARROUK, Pauline (CEA-Saclay)

Session Classification: PhD associations