History of CSNSM

The “Centre de Spectrométrie Nucléaire et de Spectrométrie de Masse” (CSNSM) was created in 1962 from the regrouping of the former Bellevue Permanent Magnet Laboratory of Aimé Cotton and the team led by René Bernas at IPN “Isotopic Separation and Mass Spectrometry”, whose activity concerned both nuclear physics and its applications to other scientific fields. The merger desired by the General Directors of the CNRS (Pierre Jacquinot then Hubert Curien) aimed at stimulating inter- or multi-disciplinary research.

The change of name of the laboratory in 2013, to become the Center for Nuclear Sciences and Material Sciences, without changing its acronym, focused on its research focused on nuclear physics, particle physics, sciences of the universe, condensed matter and physicochemistry of solids.

This joint research unit of the National Institute for Nuclear and Particle Physics (IN2P3) of the National Center for Scientific Research (CNRS) and the University Paris-Sud was marked by the multidisciplinary nature of its research. These activities covered a very wide range of themes among which we distinguished the experimental nuclear physics activities gathered around the group on nucleus structure, the astrophysics activities carried out by the solid astrophysics and nuclear astrophysics groups and the activities of physics of materials and chemistry of the solid led by the groups of physics of the solid and Materials and Irradiation.

History of IMNC

Supported by the Université Paris Diderot and Université Paris-Sud, on the one hand, and the CNRS through the IN2P3 and the INSB, on the other hand, the Imaging and Modeling unit in Neurobiology and Cancerology (IMNC) was created on January 1, 2006 This laboratory brought together biologists, physicists and doctors in the same interdisciplinary framework and around questions on the complexity of the Living:

• Preclinical and clinical multi-modal imaging (optical and isotopic) for which the laboratory has implemented innovative detectors for in vivo imaging of small animals or outpatient clinical imaging (diagnosis, assistance with surgical treatment, monitoring therapeutic). If the clinical aims of this theme were clearly oriented towards oncology, its biological orientations favoured more neuroscience with in particular the development of a fundamental axis turned towards the study of cerebral energy metabolism and the cellular bases of neuro-energetic coupling.
• The modeling of tumor processes and its applications to cancer diagnosis was particularly interested in multi-scale modeling of tumor growth and migration and was closely coupled with a statistical physics component which was interested in the modeling of biological systems.
• Radiotherapy aimed at the development of radiotherapy systems / methods based on new approaches to dose deposition (mini-beams X protons, nanoparticles) and associated radiobiological studies.

Drawing on a large network of collaborations, the laboratory has developed these themes on the basis of solid expertise in instrumentation, simulation and modeling.

History of IPN

The IPN was born on the initiative of Irene and Frédéric Joliot-Curie, both winners of the Nobel Prize in Chemistry 1935. Irène Joliot-Curie took the initiative of founding the new laboratory in Orsay in 1956 but did not not seen the completion of building construction work, dying the same year from leukemia. Her husband Frédéric Joliot-Curie, although sick himself, was then asked by the Faculty to take over. In addition to the nuclear physics course and the university chair, he was therefore required to direct the Orsay laboratory, the Curie Laboratory, its laboratories at the Collège de France and in Ivry. Two years after the founding of this new laboratory, Frédéric Joliot-Curie ensured the completion of the first buildings in Orsay, the start-up of the synchrocyclotron, the gathering of the majority of the personnel of the different laboratories, the organization of work and the creation of a first canteen. The first physicists arrived in Orsay in the spring of 1957. Frédéric Joliot-Curie obtained the move of the cyclotron from the Collège de France to Orsay. While at the beginning of June 1958, the synchrocyclotron delivered its first internal beam, Frédéric Joliot-Curie died on August 14 of the same year.

Jean Teillac was called to succeed Frédéric Joliot-Curie. The name "Laboratoire Joliot-Curie" was given to what constituted until the end of 2019, the Institute of Nuclear Physics of Orsay (IPNO). It was then part of a set which also included the Curie laboratory of the Radium Institute, the Arcueil laboratory, temporarily the Ivry laboratory - where Georges Charpak (future Nobel Prize winner) made the first tests of wire chambers , before coming to Orsay for a few months and then joining CERN - and, later, the High Energy Laboratory of the Halle aux Vins (Jussieu). A group of Orsay physicists working on particle physics will subsequently create a new laboratory in Annecy-le-Vieux, near CERN. Mass spectrometry and nuclear spectrometry will be brought together at the CSNSM. The future IPN was first part of the Faculty of Science of Paris, center of Orsay; but faced with the delays in the construction of the Wine Hall, the dean decided to establish a first cycle on the Orsay grounds (1958). The center of Orsay will become in 1965 the Faculty of sciences of Orsay of the university of Paris, then of the university Paris XI (Paris-Sud) in 1970.

In 1966, the Institute of Nuclear Physics took the name that it kept until 2019. A new accelerator, the variable energy cyclotron (CEV) for heavy ions was launched, supplemented by a linear accelerator (LINAC), acting as an injector, is attached to it. This technological feat led to the creation of the Alice accelerator, the world's first machine capable of accelerating very heavy ions such as krypton. In 1972, a Van de Graaff TANDEM 10 MV accelerator (increased to 15 MV) was installed. The physicists who worked with the Ivry betatron joined Orsay. The laboratory was therefore able to tackle all areas of nuclear physics. The IPN is strongly involved in carrying out the GANIL (large national heavy ion accelerator) in Caen, and more modestly in that of the National Saturn Laboratory (around the Saturn 2 synchrotron) in Saclay. From the 1980s, the evolution of French research led to the closure of the CEV, to retraining for radiotherapy, to the development of numerous international collaborations, and to the renewal of the TANDEM experienced. The IPN also produced with its own forces a cyclotron with superconductive coils, the first in Europe initially designed to replace the CEV and the synchrocyclotron with TANDEM as an injector. AGOR (Accelerator Groningen), a supra 300 T cyclotron, was the subject of an international collaboration between KVI and IPN Orsay.

The accelerator division of IPN strongly contributed to various projects in the early 2000s: the SPIRAL1 project in collaboration with GANIL, the construction of the LHC at CERN in Geneva, the very high intensity electron and hadron beams. Other projects included participation in ALICE (quark and gluon plasma), AUGER (cosmic rays), JLab (proton structure), as well as several detectors for nuclear physics (AGATA, INDRA, MUST, MUST2), and associated theoretical physics studies. Finally, various R&D programs have given birth to the ALTO project: an electron accelerator converted into photons to produce nuclei very rich in neutrons by photo-fission.

LABORATOIRE DE L'ACCÉLÉRATEUR LINÉAIRE

History of LAL

The Linear Accelerator Laboratory (LAL), founded in 1955 by Professor Yves Rocard, was a joint research unit of the National Institute of Nuclear Physics and Particle Physics (IN2P3) of the CNRS and the University Paris-Sud until the end of December 2019.

It was under the leadership of its director, Professor Yves Rocard, that the physics laboratory of the École normale supérieure in Paris started in 1955 the construction of the Linear Accelerator Laboratory in Orsay to give scientists an accelerator of 'electrons. Construction was completed in 1958 and the first experiments took place in 1959. The staff was made up of researchers and technical staff from the École Normale Supérieure, which was too cramped in its Paris premises. The first phase of construction was completed in 1962, as well as the electron-positron collision ring ACO (Orsay collision ring) which was a circular accelerator where the matter-antimatter annihilation was studied.

From 1965 to 1968, construction of the linear accelerator was completed, bringing its energy to 2.3 GeV. At that time, the Linear Accelerator Laboratory was one of the largest laboratories in the world in the field of high energy physics. Little by little, more efficient tools at CERN or DESY (Hamburg) will distance physicists from this proximity tool.

In 1973, a new laboratory was created to use the accelerator beam, it was the Laboratory for the Use of Electromagnetic Radiation (LURE). 1976 saw the entry into service of the DCI collision and storage ring for particle physics, capable of also serving as an X-ray source for LURE. In 1985, LAL and LURE became two separate entities. LURE continued to operate the Linac accelerator and the ACO and DCI synchrotons, until the takeover of its facilities by SOLEIL in 2001 and the closure in 2003. In 2004 began the dismantling of the linear accelerator.

During this period, LAL participated more and more in large international experiments in particle physics, then from 1987, in experiments of physics except accelerator and towards astrophysics. The main research themes were particle physics (the study of the most basic constituents of matter, the historic core business of LAL), astroparticles (the study of radiation from the Universe) and cosmology (history, composition and evolution of the Universe).

LPT Orsay

History of LPT

Yves Rocard, director of the physics department at the ENS encouraged Maurice Lévy to create a team in theoretical physics in the early 1950s. Finding the premises too cramped, the group moved to the Orsay campus in 1959-1960. Among the founders were Bernard Jancovici, Khosrow Chadan, Jean Tran Tanh Vanh and Roland Omnès. The laboratory brings together theorists in particle physics predominantly, ahead of statistical physics and solid state physics.

The laboratory, then called Laboratory of Theoretical Physics of High Energies (LPTHE) includes up to a hundred researchers, which prompted Maurice Lévy to reform a laboratory of theoretical physics in the center of Paris, on the Jussieu campus, in 1966, which brings together some of the laboratory's researchers. In 1970, Philippe Meyer leads another part of the LPTHE researchers to create the ENS theoretical physics laboratory in Paris.

In the 70s, the LPTHE is developing strong links with the LAL for the analysis of particle physics experiments in close collaboration with the experimenters. The objective is in particular the study of the properties of the strong interaction and the description of the resonances observed experimentally, in particular by the development of models of quarks. The members of the LPT, under the leadership of Loup Verlet, were instrumental in the creation of the IT department of the Orsay campus by installing the first computing machine there. Since then, the LPT has always retained an internationally recognized know-how in digital simulations, whether for liquid physics or for high energy physics (quantum chromodynamics on a network).

In the 1980s, the laboratory iss at the forefront in the quantification of gravity by the approach of non-commutative geometry. The arrival of Pierre Binétruy in the early 1990s marks the rise of cosmology in the laboratory, which will partly continue with the creation of the APC laboratory in Paris. The laboratory changes its name in 1999 to become the laboratory of theoretical physics or LPT. This Joint Research Unit of the CNRS Institute of Physics and the University of Paris-Sud continues to develop new themes (theories beyond the Standard Model of particle physics, matter and dark energy, new applications of statistical physics) until the end of 2019.