History of LIPhy

Prehistory

The prehistory of what was to become the *Laboratoire Interdisciplinaire de Physique* is outlined in the Appendix. Louis Néel (Nobel Prize in Physics, 1970), the driving force behind the development of physics in Grenoble after World War II, was the instigator. Michel Soutif,[1] invited in 1951 by Néel to come from Paris, in 1958 became director of the General Physics Laboratory of the Institut Fourier in Place Doyen Gosse, near Grenoble railway station. That was where the *Laboratoire de Spectrométrie Physique* was conceived.

Michel Soutif in 2002 (photo S. Claisse, ILL)

Spectro

Dates/*Director*

1st January 1966
M. Soutif

The Laboratoire de Spectrométrie Physique was officially recognized as an associate laboratory of the CNRS, with Michel Soutif as director, and Jean-Claude Pébay-Peyroula assistant director.

The laboratory set out with a complement of 65 full time research workers, university lecturers (known as *teacher-researchers*), and graduate students, with 28 supporting technical and administrative staff. The lab was made up of 10 research groups: Crystal structures (Janine Lajzerowicz, Pierre Ducros), Surface science (Pierre Ducros, Joseph Lajzerowicz), Molecular physics (André Kahane), Molecular spectroscopy (Josette Kahane), Atomic Physics (Jean Claude Pebay-Peyroula), Theoretical Physics (Yves Ayant), Nuclear magnetic resonance in metals (Pierre Averbuch), Ferroelectrics (Joseph Lajzerowicz), Adsorbed phases (Jean-Pierre Cohen-Addad, who, on returning later from post-doctoral studies in the United States, introduced the theme of NMR in polymers), and, finally Electron spin resonance, headed by Michel Soutif. For historical reasons (see Appendix), this last group was the recipient of substantial support from a contract with the French telecommunications company Alcatel[2], and in addition was reinforced by a team of engineers, including Yves Merle d'Aubigné, Roger Buisson, Denis Descamps and Raymond Chicault. The financial support of the Alcatel contract enabled to the whole laboratory to invest in scientific equipment.

The declared mission of the laboratory was the study of matter by "*spectrometric*" techniques. The spectrum ranged from radiofrequencies, microwaves, infrared and visible optics, to X-rays, in addition to slow electron spectroscopy. The principal thrust was experimental, but it was reinforced by the theory group, under Yves Ayant. Ayant's outstanding ability marked generations of Grenoble students and research workers.

September 1967

The personnel and equipment of the laboratory migrated to its present site in Physics Building E (PHITEM) on the University Campus of Saint Martin d'Hères. This was part of

a historical flood plain, an open area of wide green spaces, with airport runway-like avenues, and sparse buildings. The early University research buildings were constructed on stilts, a precaution against flooding by the nearby Isère river. Since then, the banks of the Isère have been substantially reinforced and raised.
With time, the laboratory came to be known familiarly, even affectionately, as *Spectro*.

During this period, under the guidance of L. Néel and E. Lewy-Berthaut on the French side, and H. Maier-Leibnitz on the German side, the Franco-German high flux reactor Institut Laue-Langevin took shape on the peninsula between the Isère and the Drac rivers on the opposite side of Grenoble. This international institute, of which Great Britain later became an associate, was to prove a major driving force in the scientific development of Grenoble. During the construction period of the reactor it was realised that relevant scientific research was essential on the site. *Spectro* became deeply involved in the project, with Janine Lajzerowicz engaged in setting up the X-ray equipment, including a 4-circle spectrometer. When Heinz Maier-Leibnitz, the first director of the ILL, proposed the idea of gamma ray spectroscopy, Joseph Lajzerowicz collaborated in the design of a gamma ray source and the accompanying spectrometer. In the following years *Spectro* remained strongly involved at the ILL, notably with students from Jo Lajzerowicz's group, Pierre Bastie, Marc Bée, Jean-Francois Legrand, among others.

French education underwent a paradigm shift. The unrest of 1968, in which students played a prominent role, had seriously shaken the political establishment. Educational reform was urgent. With insufficient infrastructure or regard for the informal side of student life, universities had become impersonal and a source of dissatisfaction. Part of the solution, in the reform of Edgar Faure in 1968, was to *downsize large universities*. The University of Grenoble, with 30,000 students, was split into three separate universities: the Université des Sciences Juridiques et Economiques, the Université des Langues et Lettres, and the largest of the three, the Scientific and Medical University of Grenoble (Université Scientifique et Médicale de Grenoble) were born. *Spectro* belonged to the largest group.

1970 Contract of association with the CNRS renewed, and *Spectro* became *CNRS Associate Laboratory N°8* (LA n°8). It now boasted approximately 80 research workers, visitors and graduate students, with 44 technical and administrative staff.

1971 Michel Soutif was elected President of the Université Scientifique et Médicale de Grenoble.

1972 With the support of Michel Soutif, resources from the then 5th Plan were assigned to expand *Spectro* to create a "multidisciplinary laboratory that involved physicists and chemists with an interest in biology". The new building, the Centre for Studies and Research in Organized Molecules, known as the CERMO, was constructed next to the original building. Two groups from *Spectro*, NMR in Polymers and Biopolymers (Jean-Pierre Cohen-Addad), and Molecular Crystals and Molecular Spectroscopy (Josette Kahane) moved into CERMO, together with five other groups of biologists and chemists from outside, including Biology (J. Pelmont), Chemistry of Fluorine Compounds (C. Béguin), Physical Chemistry of Ionic Polymers (G. Brière). The proximity of these different disciplines gave rise to fruitful collaboration, but fusion into a multidisciplinary laboratory was not intended. Another two decades passed before the interests of physicists and biologists converged sufficiently for genuine collaboration to take place. During this period, members of the teaching staff of *Spectro* (J. Kahane, A. Kahane, E. Belorizky, M. Soutif) also became involved in the teaching of physics at the Centre Universitaire de Savoie at Jacob Bellcombette, Chambéry. In addition, an extension of the NMR in Polymers and Biopolymers group was established there to develop dynamic light scattering spectroscopy (E. Geissler, A.M. Hecht). When the University of Savoie became independent in 1982, this activity was repatriated to *Spectro*.

1974 Laser spectroscopy developed under Jean-Michel Hartmann. Permanent employees (researchers and technical staff) stabilized, with 47 university lecturers and 25 CNRS researchers. Despite a high turnover rate these numbers stayed practically constant until the clearance of 2007 (see below). Nevertheless, the number of post-graduate students (troisième cycle) decreased.

During this period significant advances were made in theoretical approaches, with calculations of electronic transitions (Maurice Lombardi) and in electron and nuclear magnetic resonance (Elie Belorizky).

1977
J.-C. Pébay-Peyroula

The Electron spin resonance group evolved into Solid State Optics (OPSO), with Yves Merle d'Aubigné, Roger Buisson, Robert Romestain, Jean-Claude Vial, Joël Cibert, and others. On the death of G. Brière, his group in CERMO was renamed Semiconductors and Electrochemistry and became part of *Spectro*, under François Gaspard. Research into semiconductors started in earnest.

The laboratory entered into a period of turbulence. The salary scale of the technical and administrative staff on the university payroll differed from that of the CNRS. After a decision by *Spectro* to align the two salary scales through payments out of the budget of the National Education was declared illegal, both J-C. Pebay Peyroula and M. Soutif were placed in an irregular situation, and Soutif was even taken to court. The case, however, was dismissed, but in the ensuing storm, the cohesion of the laboratory and its ability to carry out its research mission survived. The survival stands as a tribute to the combined tact and diplomacy of J-C. Pebay Peyroula and of the assistant director, Michel Minier.

Higher Education in France fell on lean times. In 1977 only one Further Study (DEA) student was recruited in the whole laboratory. Young research workers at that time were still expected to prepare their State Thesis degree (Thèse d'Etat), which required six or seven years of study.

1980

First experiments in high sensitivity absorption in gas phase using intracavity laser absorption spectroscopy (ICLAS). These developments opened the way to research related to the atmosphere (trace detection) and planetology (Frédéric Stoeckel, Marc Chenevier, Marie-Antoinette Mélières).

The National Centre for Telecommunication Studies (CNET) (the future *France-Télécom R&D*) opened at Meylan. In *Spectro*, this event aroused increasing interest in subjects related to microelectronics (still a long way off from the nanometre length range…).

1982
Y. Merle d'Aubigné

In the Phase Transitions group, an incommensurate phase was discovered in quartz, in a very narrow temperature range. (Gérard Dolino).

1984

NMR observation of incommensurate charge density waves in metals (Claude Berthier).

The death of Michel Minier, CNRS research director, killed in an avalanche while skiing, was a tragic loss for the laboratory.

1985

The very beginning of studies in porous silicon. In the course of 15 years these investigations attracted an increasing number of researchers, drawn from three groups in *Spectro*, Semiconductors and Electrochemistry, Solid State Optics, and Phase Transitions and Structures. Notable contributors to this field were Mireille Ligeon, François Gaspard, Roland Hérino, Irina Mihailescu, Robert Romestain, Jean Claude Vial, among others.

Work started on local electric field mapping in plasma discharges (Jacques Derouard, Nader Sadeghi).

1987
J. Kahane

Another paradigm shift: it is decided that the criterion for international recognition of an institution is its *name*. The Scientific and Medical University of Grenoble becomes Université Joseph Fourier,[3] while the other two universities are respectively rebaptised Pierre-Mendès-France and Stendhal.

A Mixed CEA-CNRS Group was created to build, on the premises of DRFMC, a molecular beam epitaxy apparatus to manufacture semiconducting structures. Several members of *Spectro* joined in this project, including Y. Merle d'Aubigné, H. Mariette, S. Tatarenko, Le Si Dang, A. Wasiela and J. Cibert.

July 1991
J. Lajzerowicz

The area of the laboratory was expanded to occupy the empty space bounded by the pillars of the ground floor. Work on lasers could safely be relocated there - the historical records attested that no flooding incidents on the ground floor could be attributed to the Isère and that all water spillages were traceable to the upper levels of the building.

On the appointment of J. Kahane as director of the Grenoble-Drôme-Ardeche University Centre in Valence, Hans Peter Trommsdorff became head of the Molecular Spectroscopy group.

1992 A major new scientific player entered the Grenoble scene: the European Synchrotron Radiation Facility (ESRF) produced its first X-ray beams. This powerful light source had originally been mooted for Strasbourg by the then Minister of Science, Hubert Curien, but an intervention by L. Mermaz with the President of the Republic, F. Mitterand, swayed the balance in favour of Grenoble. Michel Soutif, mandated to gauge the opinion of the President of the German Republic on this matter, met with a favourable response.

Spectro, as part of a collaborative research group (CRG) became directly involved in the construction of the first beam lines at the ESRF, notably the small angle scattering instrument BM02. It was among the very first beam lines to become operational (E. Geissler, C. Rochas).

The Phase Transition group became interested in soft matter: films and membranes floating on the surface of water. Biophysics entered the picture (two successive researchers spent a postdoctoral internship with Albert Libchaber of Rockefeller University), as well as complex systems and morphogenesis.

Research into electro-wetting phenomena by Bruno Berge preluded the foundation of VARIOPTIC, a company that he later created on the basis of a patent lodged under his own name and that of UJF.

The number of 3rd Cycle thesis students, and the later "New Thesis" students, increased from 3 in 1981 to about 20 in 1989, soon rising to about 40. The qualifying university degree, the "State Thesis" was abandoned, to be replaced by the Certificate of Authorisation to Direct Research (HDR).

1993 The Surface and Interface group (R. Baudouin) left *Spectro* to join the Laboratoire de Cristallographie at the CNRS site in avenue des Martyrs.
Chaouqi Misbah, coming from the Solid State Physics Group at the l'Ecole Normale Supérieure, and subsequently the theory group of P. Nozières, joined the Phase Transition group in *Spectro*, where he initiated the study of complex fluids.

1994 Inauguration of the ESRF.

Migration of the Nuclear magnetic resonance in metals group to the High Field Magnetic Laboratory LCMI (Claude Berthier, Hadrien Mayaffre, and others)

1996 *M. Vallade* The *Institute of Condensed Matter Physics* (Institut de Physique de la Matière Condensée) was established, with *Spectro* as an associate member.

Increasing interest displayed in research related to life sciences, under various forms. A CNRS researcher was appointed to *Spectro* by a biology commission.

Cavity Ring Down Spectroscopy (CRDS) was introduced, later to be refined into a compact device for detecting CO, CO_2, NH_3, CH_4, and other trace molecules in the atmosphere (Daniele Romanini, Guillaume Méjean)

2000 Launch of the *State-Region Plan Contract* (CPER) project entitled *New Approaches to Life Sciences* (under the initiative of Marcel Vallade) and of the CPER *Nanophysics*. *Spectro* was deeply involved in both of these highly beneficial projects.

The Atomic and Molecular Physics group split into two: 1) Laser Optics and Applications, and 2) Laser, Molecules and Environment.

2000 *R. Hérino* The character of the Laboratory changed markedly, with increased emphasis on research into "complex systems", developments in near-field microscopy, and ultrasensitive optical detection systems and their applications. Over the course of several years the laboratory personnel was substantially renewed.

The 4-year Activity Report of the Laboratory in 2002 announced 3 principal research themes:

Solid State Physics and Nanophysics,
Molecular Physics, Optics and Applications

Morphogenesis, Soft Matter and the Physics-Biology Interface.

2003 Installation of the Two Photon Intravital Microscopy platform, in collaboration with research workers from the future Neuroscience Institute (Institut des Neurosciences).

2004 Another tragic loss occurred for the laboratory, Robert Romestain, CNRS research director, died in a climbing accident.

B. Boulanger Launch of the *NanoBio* programme by UJF and CEA-Grenoble, in association with *Spectro*.

Redefinition of the laboratory research groups and substantial renewal of the personnel. Almost a third of the personnel of *Spectro* was now involved in the theme *Physics-Biology Interface*, both on the instrumental aspects and on the design aspects

2006 A severe epidemic of new scientific institutes overran Grenoble:

Minatec was inaugurated.

2007 The Institut Néel was born, with a healthy appetite. It apportioned for itself a quarter of the personnel of *Spectro*, notably the research groups Nanophysics of Semiconductors, Nano-optics and Electroactive Systems, and part of Laser Optics and Applications.

Institut des Neurosciences de Grenoble was created.

T. Dombre Launch of the National Research Initiative (aka RTRA) *Nanophysics at the limits of microelectronics,* in association with the *New Spectro* Laboratory

After the great clearance caused by the Institut Néel event, six groups remained in *Spectro*, with three main themes, Complex Matter, Optics, and Physics of/for Living Matter. Each of these themes encompassed two or three groups: Dynamics of complex fluids (DyFCOM), Soft matter: organisation, dynamics and interfaces (MODI), Optics, lasers and applications (OLA), Lasers, molecules and environment (LAME), Materials, optics and techniques for life science (MOTIF), and Fluctuations, regulation and living systems (FRSV).

Collaborations with laboratories from other disciplines (life sciences, environment, medicine, mechanics, materials science, etc.) flourished.

LIPhy

2011 The name of the Laboratory changed to *Laboratoire Interdisciplinaire de Physique* (LIPhy).

Thierry Dombre left to become head of the Teaching and Research Unit (UFR) *Physics, Engineering, Earth, Environment Mechanics* (PHITEM).

J. Derouard The arrival of Jean Louis Barrat substantially reinforced activity in theoretical physics. The interface between Physics and Life Sciences was consolidated by the influx of researchers with a biological background. A new group, Statistical physics and modelling (PSM), arose under the theme Complex matter. Meanwhile the historical part of *Spectro* became involved in international projects in planetology and environment, some members even taking part in polar expeditions.
With about 130 to 150 scientists (including interns and visitors), the need for laboratory and office space now began again to be felt. The memory of the great clearance was erased.

LIPhy kept abreast of the times: contract resources increased by a factor of 2.5 over 4 years. At the end of 2014 these amounted to more than 80% of its resources: postgraduate students and postdoctoral visitors accounted for half of the research personnel.

2014 The FRSV group (Bahram Houchmandzadeh) coalesced with the microbiology group from

J. L. Barrat CERMO (Hans Geiselmann) to work on problems in connection with genetic evolution.

A quantum leap occurred in the transport infrastructure of Grenoble that bodes well for scientific integration: tramline B now connects the University Campus in St Martin d'Hères to the landlocked scientific complex on the opposite side of town: Minatec, the Institut de Physique, the CEA, IBS and the ILL/ESRF.

2015-2016 The paradigm turned a full circle: the criterion that determines international visibility (to ranking agencies) is now deemed to be *size*. The three separate Grenoble Universities unite to become the Université Grenoble-Alpes. Further plans are mooted to include Valence and the University of Savoie, plus the INPG and the CNRS.[4]

Whatever the shape of an organisation, however, the overriding requirement for international reputation is its quality. In the five decades since its inauguration the scientific context of LIPhy in Grenoble had developed almost unrecognizably. Out of the original nucleus consisting of the CEA, the CNRS, the INPG and the University of Grenoble the scientific landscape has grown at breathtaking speed, attracting major international research institutes such as the ILL, the IBS and the ESRF, and fostering the LETI, the Institute of Neuroscience and Minatec. In this environment LIPhy continues to thrive as a living organism that produces world class results in a variety of domains of physics and plays a leading role in the extraordinarily rich research environment of Grenoble. This role was expressed by Michel Soutif in an interview with the Dauphiné Libéré on the publication of his book *Grenoble, Crossroads of Science and Industry* (Grenoble, Carrefour des Sciences et de l'Industrie) Collection Les Patrimoines:[5] "*To explain the development of science and of the University in Grenoble, I divided the tale into three seasons: 1850-1900, the season inventions, 1900-1950, the season of engineering, and 1950-2000, the season of research"*

"What would you call the fourth "season" of Grenoble, from 2000 to 2050?"

"I would not venture to anticipate beyond reason, but I have faith nevertheless in the high scientific level and in the growth of life sciences in Grenoble: projects that are underway such as NanoBio, the Grenoble Institute of Neurosciences, or the Institute of Molecular and Structural Biology bear witness to the vitality of Grenoble in the field of medicine and biology. In fact that is the last chapter in this little book.

Throughout its history, the success of the laboratory has, of course, always been due to its research workers and technical staff, but not only. The role of its infrastructure, notably the mechanical workshop, where many of the instruments were developed, has been of paramount importance. This workshop, the only of its kind on the university campus, has provided essential services to other laboratories on the site.

Appendix

The history of what was to become the *Laboratoire Interdisciplinaire de Physique* is rooted in the context of hydroelectric power, which developed in the Grenoble region at the end of the 19th and the beginning of the 20th century. New industries spawned–and with them, an engineering school– the INPG.[6] It was in this fertile ground that the first seeds of the laboratory were planted. Its existence, however, was profoundly shaped by the events of the Second World War. In 1940, Louis Néel[7,8,9] arrived in Grenoble, then part of France not under direct German rule. His settling in Grenoble was facilitated by the offer of the empty premises of the Institut Fourier, recently constructed by the Dean of the University, the mathematician René Gosse.[10] (René Gosse was assassinated in 1943 for opposing the German occupation.)

Néel's work at the outbreak of war on demagnetizing naval ships in Brest, Cherbourg, Dunkirk and le Havre, had released French warships from the Atlantic ports, where they had been blocked in port by German magnetic mines. This enabled them to escape to England and to take active part in the evacuation of Dunkirk[11] just before the armistice. Néel's action saved the lives of thousands of sailors.[12] Two years later, when the British-American armies invaded North Africa, the German army advanced into the unoccupied part of France, while Savoie –along with Grenoble– was appropriated by Italy. For a fortunate few, including Erwin-Felix Lewy-Bertaut, Louis Weil, Noël Felici, and Anatole Abragam,[13] the Italian land-grab saved their lives: their less-than-systematic administration enabled several brilliant scientists to avoid discovery and being sent to certain death in concentration camps.

At the end of the war, Néel remained with a group of dedicated survivors in Grenoble, resisting the centralising power of Paris. Physics departments at French universities, weakened by the war years, lagged seriously behind recent advances. In 1951, by virtue of his immense prestige both with the military and with the new government, he could invite to Grenoble the foremost graduate from the Ecole Normale Supérieure in Paris, the young Michel Soutif, and offering him a post at the University. Soutif's mission was to bring to the provinces the latest ideas and experimental developments in physics. For this task, he was outstandingly well prepared.

In the course of his doctoral thesis at the ENS, Michel Soutif had founded the high frequency laboratory SACM (societé alsacienne de constructions mécaniques), later to become Alcatel.[2] Together with the CNET he built the first Hertzian telephone link connecting Mount Boron (Nice) with Corsica. From its beginnings in 1948, upon the creation of the general physics laboratory, a branch of Alcatel dedicated to research into millimetre wavelength radiation was established in the Grenoble laboratory. It comprised 4 engineers and 4 technicians. In spite of the very different contractual terms, it fitted perfectly into the laboratory and its generous financing contributed to the purchase of scientific equipment for all the research groups. When this collaboration came to an end in 1970, only Denis Descamps left Grenoble. Roger Buisson became director of the Institut Universitaire de Technologie (IUT1),[14] Raymond Chicault joined the CEA[15] and Yves Merle d'Aubigné was appointed Research Director at the CNRS.

Prior to Soutif's arrival in Grenoble, the teaching staff of the physics department was composed of René Fortrat, professor, and M. Malraison, assistant. Since Néel had omitted to inform Fortrat of Soutif's appointment, when the latter introduced himself, Fortrat's surprise was total. After an initial chilliness, however, the two were able to cooperate fully. Soutif immediately set to work assembling instrumentation to perform electron spin resonance, using a low voltage electromagnet acquired from Bordeaux and a power supply consisting of German submarine batteries backed up by an electric generator.

Soutif's arrival brought not only his technical expertise in magnetic resonance as well as a cluster of recently graduated doctoral students, but also his formidable teaching and organising skills. In 1958 Soutif replaced René Fortrat as director of the General Physics Laboratory of the Institut Fourier in Place Doyen Gosse near Grenoble railway station. That was where the Laboratoire de Spectrométrie Physique was conceived. Since retiring from his official duties, Michel Soutif has continued to contribute actively to the propagation of science and scientific ideas in the community.[16]

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