LAPTH - Laboratoire d'Annecy-le-Vieux de physique théorique

Rapport Hcéres

agence d'évaluation de la recherche
et de l'enseignement supérieur

Section des Unités de recherche

AERES report on the research unit

Laboratoire d'Annecy-le-Vieux de Physique Théorique (LAPTH)

From the

Université de Savoie

CNRS

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agence d'évaluation de la recherche
et de l'enseignement supérieur

Section des Unités de recherche

Rapport de l'AERES sur l'unité :

Laboratoire d'Annecy-le-Vieux de Physique Théorique

(LAPTH)

Sous tutelle des établissements et organismes

Université de Savoie

CNRS

Le Président de l'AERES	Section des unités de recherche
	Le Directeur
Jean-François Dhainaut	**Pierre Glorieux**

Juillet 2010

Research Unit

Name of the research unit : Laboratoire d'Annecy-le-Vieux de Physique Théorique

Requested label : UMR

N° in the case of renewal : UMR 5108

Name of the director : Mr Fawzi BOUDJEMA

Members of the review committee

Committee chairman:

Mr Constantin BACHAS, Ecole Normale Supérieure

Other committee members :

Mr Pierre FAYET, Ecole Normale Supérieure

Mr Nigel GLOVER, University of Durham

Mr Wolfgang HOLLIK, Max Planck Institute, Munich

Mr Subir SARKAR, Oxford University

Mr Jean-Marc VICTOR, University Pierre et Marie Curie (Paris 6)

Committee members suggested by CNU, CoNRS, CSS INSERM, CSS INRA, INRIA, IRD :

Mr Olivier BABELON, CoNRS

Mr Jean ORLOFF, CNU

Observers

AERES scientific advisor:

Mr Claude LECOMTE

University, School and Research Organization representatives:

Mr Patricio LEBOEUF, CNRS/INP

Mr Gilbert ANGENIEUX, President of the Université de Savoie

Report

1 • Introduction

- Date and execution of the visit :

The committee met in the laboratory building on January 14 and 15, 2010. The outgoing director first gave a presentation of the laboratory, of its history, activities and resources. This was followed by presentations of the past achievements and future plans of the three research teams (Mathematical Physics including Biophysics, Particle Physics, and Astrophysics/Cosmology), and by a short presentation of outreach activities. The new director then described the plans of the laboratory for the coming four years, after which the committee split in three groups which interviewed the three research teams separately. Finally, there was a meeting with all members of the laboratory and, on the following day, three separate meetings with (1) representatives of the supporting organizations (CNRS and Université de Savoie), (2) students and postdoctoral fellows, and (3) the new and outgoing directors of the laboratory, and of the associated federation.

The committee thanks the directors and the staff of LAPTH, as well as the representative and support staff of the AERES, for the flawless organization of this visit. It also appreciated the availability of all members of the laboratory to assist it in its task. The direction of the LAPTH and the AERES had provided beforehand the committee with detailed documentation, including an activity report, a future project, and grids of the human and funding resources of the laboratory. These were clearly-written, informative and succint, and were of great help to the committee.

- History and geographical localization of the research unit, and brief presentation of its field and scientific activities :

The LAPTH is located in Annecy-le-Vieux, in a building shared with the LAPP, a large experimental high-energy physics laboratory. The site is about 40 km from CERN, and from the main site of the University of Savoie in Chambéry. The laboratory grew out of an associated research unit with two branches in Annecy and Lyon, and became a mixed research unit of CNRS and the University of Savoie in 1998. It is at present part of a federation with the LAPP and the LAMA, the laboratory of mathematics in Chambéry. The research activities of LAPTH cover the areas of mathematical physics, particle physics, and astrophysics and cosmology, with a small nascent activity in biophysics.

- Management team :

There was a change of director on january 1st. The incoming director will be assisted by an assistant director, three team leaders, a scientist in charge of outreach activities, and a very efficient secretarial staff. Most of the important decisions are taken by the « Conseil du Laboratoire » in which all permanent members of the laboratory, as well as non staff members who have spent more than one year at LAPTH, participate. Both the past and the present direction should be commended for a smooth and efficient running of the laboratory, and for maintaining a very friendly and consensual atmosphere among the staff.

- Staff members (on the basis of the application file submitted to the AERES) :

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	7
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	12
N3: Number of other researchers (Forms 2.2 and 2.4 of the application file)	4
N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	2.4
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	0.8
N6: Number of Ph.D. students (Form 2.7 of the application file)	7
N7: Number of staff members with a HDR or a similar grade	12

2 • Overall appreciation on the research unit

- Summary :

LAPTH is one of the best French laboratories of theoretical physics, at the forefront on the international scene in all its three main areas of activity: particle physics, mathematical physics, and astrophysics/cosmology. This is quite remarkable, given the relatively small size of the laboratory. The scientific production is regular and very well-balanced across the fields .

All three teams are well-inserted in the broader European research landscape, as evidenced by collaborations, participation in networks, invitations to (and organization of) conferences or workshops, and their ability to attract first-rate students and postdocs. The coexistence and good relations with LAPP, and the proximity of CERN, offer many opportunities which are being well exploited. Some room for improvement exists, especially in the visitor/seminar program.

There is an excellent atmosphere in the laboratory, thanks in part to the actions of the directors and to a very efficient secretarial staff. There is a good communication between the teams, as well as with the scientists of LAPP, and a high potential for innovative collaborations.

- Strenghts and opportunities :

LAPTH has a rare mix of first-rate expertise in both the formal and the phenomenological aspects of fundamental physics, ranging from string theory and the search for new physics in accelerator experiments, to astrophysics and cosmology. The laboratory is in an excellent position to participate in the analysis of data from the LHC, Planck, and other experimental and observational projects, as this data will become available in the next few years.

LAPTH is well inserted in the European research landscape, as previously mentioned. The international collaborations, organization of conferences and workshops, and the participation in funding schemes, offer many opportunities to the younger members of the laboratory.

The laboratory has a unique program of outreach activities, addressed both to the wider public and to local high-schools. These help the integration of LAPTH in the region, and augment the visibility of fundamental science in a broader sense.

- Weaknesses and threats :

The lack of sufficient office space is a problem, both for the resident scientists and for the visitor program. Other than the director of the lab, all other members share at present their office. This is a handicap, since private discussions with students, collaborators and/or visitors is a very important part of the daily routine of a theoretical physicist.

The biophysics activity, especially in proteomics, is innovative and interesting, and the directors of LAPTH and the federation MSIF must be commended for their initiative. The activity relies, however, at present on two non-permanent members of LAPTH and is, consequently, rather fragile. A further aggravating factor is the absence of a nearby biology laboratory with which the team could scientifically interact.

Several members of the laboratory teach at the University of Savoie, as well as in the Ecole Normale of Lyon, at the undergraduate and graduate level. This is important for attracting students to the laboratory. The geographical separation from these University campuses is, nevertheless, a handicap. Another limiting factor is the lack of a sufficient number of PhD scholarships -- an endemic problem of the french higher-educational system.

- Recommendations :

LAPTH should be commended for its active participation in the academic life of surrounding Universities. It is important that this involvement be continued and strengthened. The inclusion of the University of Savoie in the PRES of Grenoble could offer opportunities, especially for improving the PhD-fellowship problem.

The biophysics team should be given some more time and adequate support to pursue its current research direction. The results and prospects of this activity must then be evaluated by biology and biophysics experts, before reaching a final decision whether to stabilize biophysics in LAPTH in the longer run. If followed by the appointment of a professor with a multidisciplinary profile at the University of Savoie, such a decision could have the added benefit of attracting some more students to physics, both at the License and the Master's level.

A regular colloquium covering developments in all areas of physics is lacking. This is important for the training of young scientists in a pure-research facility like LAPTH, located far from a University campus.

The recent departures of young researchers to CERN, Karlsruhe and Paris is a sign of the quality and dynamism of the LAPTH staff . These and the retirement of senior members were only partially compensated by high-quality recruitments in recent years. It is essential to maintain a policy of recruiting the best possible candidates both in CNRS and the University, and of trying to improve, as much as possible, their day-to-day working conditions.

- Production results :

(cf. http://www.aeres-evaluation.fr/IMG/pdf/Criteres_Identification_Ensgts-Chercheurs.pdf)

A1: Number of lab members among permanent researchers with or without teaching duties who are active in research (recorded in N1 and N2)	19
A2: Number of lab members among permanent researchers with or without teaching duties who are active in research (recorded in N3, N4 and N5)	1
A3: Ratio of members who are active in research among staff members [A1/(N1+N2)]	19/20
A4: Number of HDR granted during the past 4 years	0
A5: Number of PhD granted during the past 4 years	14
A6: Other relevant item in the field	-

3 • Specific comments

- Appreciation on the results :

The quality of the research conducted at the LAPTH is first-rate. All three teams have made important contributions to their respective, very competitive areas of frontline research: mathematical physics, particle-physics phenomenology and astrophysics. The biophysics activity that grew in the mathematical-physics group, is innovative and interesting. For a description of the achievements of each team please see section 4.

The productivity of the laboratory is excellent and very well-balanced across the teams. Over 180 articles were published in international peer-reviewed journals, and more than 60 communications in conference proceedings. The latter attests to the high visibility of LAPTH in the international scene.

They were 14 students graduating with a PhD in the last four years, twice as many as in the previous four-year period. This is a fair number by French standards, though room for improvement still exists. The PRES of the University of Savoie and the University Joseph-Fourier of Grenoble, and actions such as the recently-approved « Erasmus Mundus Joint Doctorate Programme », led by a member of the laboratory, can help. Roughly half of the graduate students completed their undergraduate studies abroad. The progress of PhD students is carefully monitored, and most of them find postdoctoral positions abroad after graduation.

The contractualisation of LAPTH as a « Unité Mixte de Recherche, CNRS – Université de Savoie » is clearly essential for the future of the laboratory. Participation in various thematic contracts and funding schemes is on the rise, as discussed below. The federation MSIF augments the visibility of the lab, and will hopefully strengthen its ties with the mathematicians of LAMA, located in the Chambéry campus.

- Appreciation on the impact, the attractiveness of the research unit and of the quality of its links with international, national and local partners :

The Dannie Heineman prize, one of the highest distinctions in Mathematical Physics, was attributed in 2009 to an emeritus member of LAPTH. Two junior members of the laboratory were recipients of the « médaille de bronze » of the CNRS, in 2005 and in 2008.

The number of permanent members of the laboratory remained stable over the last four years, but the turnover was relatively big. While departures of junior members, at CERN-Lausanne, Karlsruhe and LPTHE Jussieu, can be considered as recognition of the quality of individuals, they are a great loss for LAPTH. Part of the problem is the well-known difficulty of keeping talented scientists at the « Maitre de Conférence » level in the French system. LAPTH has managed to limit the impact of these departures by recruiting three junior researchers (one per team) through the CNRS, in 2006, 2008 and 2009. There is some concern for the tilted age distribution in the particle-physics team, whose members are furthermore heavily-involved in the direction of the laboratory.

The last four years have seen a sharp increase in funding contracts obtained on a competitive basis at the national and international level. These include three ANR projects, a Marie Curie Conference-series program, and participation in two European Research Networks. Such contracts have now become the main source for postdoctoral support. A visible result of the success of LAPTH in this respect is that the number of postdoctoral fellows is the highest ever in the history of the laboratory. Efforts to secure funding at the regional level, such as the CIPHEA project to attract researchers working at the LHC, are also worth noting.

The involvement of LAPTH members in building and developing an outreach program is truly remarkable. Initially focussed on astrophysics and cosmology, themes that have a strong attraction for the wider public, the outreach activities were later extended to particle physics and mathematical physics. The activities take various forms: public lectures, the preparation of informative leaflets, the « Faites de la Science » contest for high-school students and involvement in the annual event « Fête de la Science ».

- Appreciation on the strategy, management and life of the research unit :

Part of the success of LAPTH can be attributed to the friendly and consensual atmosphere reigning among its members. Because of the small size of the lab, most decisions can be discussed and taken by the « Conseil du laboratoire », composed of all permanent members of the laboratory, as well as non staff members who have spent more than one year at LAPTH. Students and postdocs were unanimously pleased by their human and scientific experience at LAPTH, and by the opportunities for travel and for attending Summer schools and workshops. They also praised the availability of the director and other senior members of the lab, even though a regularly-increasing fraction of their time is nowadays taken by administrative tasks.

The scientific interactions of permanent members with the neighboring LAPP are excellent, and important for the scientific life of the laboratory. The interactions between students of the two labs can be improved. The committee also strongly recommends establishing a common regular colloquium with LAPP, to cover advances in fields other than particle physics and astrophysics.

Besides fulfilling their regular teaching duties, the seven faculty members of LAPTH are heavily involved in the organization of physics curricula at the University of Savoie. Teaching from the L1 to the M1 level takes place in Chambery, while the M2 cycles are at the University Joseph-Fourier in Grenoble and at Ecole Normale in Lyon. The distance of all these campuses from Annecy creates some obvious organization problems for members of LAPTH, but maintaining a presence at all levels of teaching is crucial. The committee commends the efforts in this direction, such as the 110 hours of courses given each year by LAPTH physicists in these M2 cycles, or the recently approved Erasmus Mundus Joint Doctorate Program « International Relativity and Astrophysics ». The lab is also present in the University at the highest administrative level: one member of the lab has been appointed Vice-President of the Scientific Council, and another has been elected to the "Conseil d'Administration" of the University of Savoie.

- Appreciation on the project :

The next four years should be an exciting period for particle physics and astrophysics, as fresh data from the LHC, the Planck satellite and other experimental and observational projects will be coming in. The committee notes with satisfaction that LAPTH is well prepared to play an important role in this novel era. Thanks to its balanced development, and to the sustained and focused efforts of its teams, the lab has acquired unique expertise in several formal and phenomenological aspects of particle physics and cosmology. Its strong ties with experimental teams, facilitated by the vicinity of LAPP and of CERN, are also an important asset for the future.

The project of reinforcing the ties with the mathematicians of LAMA is worth pursuing. The committee regrets that LAPP will not be part of the new federation, but this will hopefully not prevent the two laboratories from working closely together as they have until now. The committee is confident that any issues which may arise because of the recent changes in the organization of the CNRS will be adequately addressed. The biophysics activity is innovative and interesting, and has been commented upon in previous sections.

4 • Appreciation team by team

Title of the team : Mathematical Physics

Name of the team leader : Mr Luc FRAPPAT

- Staff members (on the basis of the application file submitted to the AERES) :

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	3
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	3
N3: Number of other researchers (Form 2.2 and 2.4 of the application file)	4
N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	NA
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	NA
N6: Number of Ph.D. students (Form 2.7 of the application file)	2
N7: Number of staff members with a HDR or a similar grade	6

LAPTH has a long tradition of maintaining an outstanding team in mathematical physics and quantum field theory. The results obtained over the period 2005-2009 are of the highest quality and cover a wide range of subjects. The team has continued to develop powerful mathematical tools, based on representation theory, to deal with general integrable spin chains and with their boundary conditions. These have potential applications to condensed-matter systems. Particularly remarkable results were obtained in the domain of maximally supersymmetric Yang Mills theory, and especially in the calculation of various scattering amplitudes for which a new « dual » superconformal symmetry was proposed. These results have connections to integrability and are also of interest to more traditional particle physics. The coexistence of all these expertises in LAPTH offers bright prospects for collaborations. The committee also notes with satisfaction that the retired members of the team maintain their activity and contribute significantly to the scientific life of the laboratory.

A biophysics activity grew within the mathematical-physics team in recent years. It is currently addressing one of the major issues in structural biology, namely protein assembly. The team developed a series of programs to efficiently scan the protein complex databases and identified some rules of assembly, which can be checked experimentally. This activity in proteomics is interesting and sound. It offers a unique convergence of theoretical physics, computational and experimental biology.

Title of the team : Particle Physics

Name of the team leader : Mrs Geneviève BELANGER

- Staff members (on the basis of the application file submitted to the AERES) :

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	1
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	6
N3: Number of other researchers (Form 2.2 and 2.4 of the application file)	0
N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	NA
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	NA
N6: Number of Ph.D. students (Form 2.7 of the application file)	2
N7: Number of staff members with a HDR or a similar grade	4

The particle physics group has done excellent work during the past few years, especially in precision calculations in the Standard Model and its supersymmetric extensions. The team has been very successful in developing codes that are widely used by the experimental and theoretical particle physics community: GOLEM and SloopS for loop calculations, micrOMEGAs for dark matter studies, SUSYbsg for the most precise calculation of b to s¤, SDECAY and SUSYHIT for supersymmetric particle decays, PHOX NLO codes for collisions involving photons or hadrons in the initial state. This is hard work of the highest professional quality.

The group deserves also a lot credit for organizing the "Physics at TeV colliders" series of workshops and the associated "Les Houches Accords". The latter set standards for the inter-operability of different codes, and had a large international impact. The next few years will provide an opportunity to exploit all these tools for physics studies at the LHC. The interactions with the astrophysics and cosmology team, mainly on the dark-matter problem, are excellent and should be continued.

Title of the team : Astrophysics and Cosmology

Name of the team leader : Mr Pierre SALATI

- Staff members (on the basis of the application file submitted to the AERES) :

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	3
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	3
N3: Number of other researchers (Form 2.2 and 2.4 of the application file)	0
N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	NA
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	NA
N6: Number of Ph.D. students (Form 2.7 of the application file)	3
N7: Number of staff members with a HDR or a similar grade	2

The activities of the team cover a broad range of subjects and are of high quality. Members of the team have obtained important results in primordial cosmology, reconstructing the inflaton potential from CMB data, and using existent and forthcoming observations to put constraints on neutrino masses. Another high-profile activity, on the propagation of cosmic rays, has proved important in interpreting the recent PAMELA observation of an excess of high-energy positrons in the sky. This excess has been widely interpreted as a possible signature of dark matter, but the absence of a similar excess of antiprotons was shown to disfavor this possibility. Other significant results of the team include the analysis of exotic dark-matter candidates as well as of some alternative hypotheses, and studies of the origin of Gamma-Ray Bursts. A great strength of the team is its proximity to current and planned experimental and observational projects.

Note de l'unité	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	A+	A+	A+	A

Nom de l'équipe : Mathematical Physics

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	A+	A+	A+	A

Nom de l'équipe : Particle Physics

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	A+	A+	A+	A+

Nom de l'équipe : Astrophysics and Cosmology

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	A+	A+	A+	A+

UNIVERSITE CHAMBERY ANNECY DE SAVOIE

Présidence

Chambéry, le 11 mars 2010

Le Président de l'Université de Savoie,

à

Monsieur le Directeur de la Section des unités de recherche
AERES
20 Rue Vivienne
75002 PARIS

Affaire suivie par :
Blandine JONCOUR
Direction de la Recherche et des Etudes Doctorales
Tél. : 04 79 75 84 10
Fax : 04 79 75 91 05
Blandine.joncour@univ-savoie.fr

N/Réf. : PRE/GA/sch/2009-10/148

Objet : Rapport du comité d'experts concernant l'unité de recherche « Laboratoire d'Annecy-le-Vieux de Physique Théorique » - UMR 5108 LAPTH
Directeur : Fawzi BOUDJEMA

Monsieur le Directeur,

Je tiens à remercier les membres du comité d'évaluation de l'AERES pour la production du rapport concernant l'unité de recherche intitulée « Laboratoire d'Annecy-le-Vieux de Physique Théorique ».

Je vous prie de bien vouloir trouver ci-joint, les observations de portée générale sur le rapport d'évaluation formulées par le directeur de l'unité, auxquelles je souscris.

Je reste à votre disposition pour tout complément d'information et vous prie d'agréer, Monsieur le Directeur, l'expression de ma considération distinguée.

Gilbert ANGENIEUX

PJ :
Observations on the AERES Report concerning LAPTH-UMR 5108 CNRS – Université de Savoie

Siège social
Université de Savoie
B.P. 1104
73011 Chambéry cedex
France

F. BOUDJEMA
LABORATOIRE D'ANNECY-LE-VIEUX DE PHYSIQUE THEORIQUE

UMR 5108
CNRS – UNIVERSITE DE SAVOIE

Tel. (dir) : 0450091688
email : boudjema@lapp.in2p3.fr
webpage : http://lappweb.in2p3.fr/~boudjema/

Annecy-le-Vieux, 4 mars 2010

Observations on the AERES Report concerning LAPTH, UMR 5108 CNRS, Université de Savoie

On behalf of all the members of LAPTH, I would like to very warmly thank all the members of the review committee for all the work and effort spent in reviewing the activities and the projects of our laboratory. The involvement of the observers is also gratefully acknowledged. All the members of LAPTH are heartened and pleased with the very positive evaluation and high recommendations made by the committee which place our laboratory "at the forefront on the international scene" and stresses the excellence of our teams with "a rare mix of first-rate expertise". I am sure that this will motivate our members in maintaining this high level of excellence.

I have only one comment to make or rather new piece of information to bring to the attention of the committee which has emerged since the visit. It concerns the biophysics activity. A BioPark is being set up in Archamps (40kms from Annecy) on the Swiss border. One of the laboratories of the BioPark is very much interested in the theoretical research being conducted at LAPTH. Discussions are well advanced for collaboration and for providing experimental facilities.

With my very best regards,

Fawzi BOUDJEMA, Directeur du LAPTH