LPT - Laboratoire de physique théorique

Rapport Hcéres

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

Section des Unités de recherche

Evaluation report

Research unit :

Laboratoire de Physique Théorique

(LPT) – UMR 8627

University of Paris 11

January 2009

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et de l'enseignement supérieur

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Le Président
de l'AERES

Jean-François Dhainaut

Section des unités
de recherche

Le Directeur

Pierre Glorieux

january 2009

Evaluation report

Research unit :

Name : **Laboratoire de Physique Théorique**

Requested label : **UMR**

N° in case of renewal : **8627**

Head of the research unit : **Mr Henk HILHORST**

University or school:

University of Paris 11

Other institutions and research organization:

CNRS

Date(s) of the visit :

December 1st and 2nd of 2008

Visiting committee

Chair:

Mr Carlo ROVELLI, Université de la Méditerranée

Members:

Mr Jean-Pierre HANSEN, University of Cambridge

Mr Chris QUIGG, Fermi National laboratory USA

Mr Rainer VERCH, Université de Leipzig

Mr Fernando QUEVEDO, University of Cambridge

Experts representing evaluation committees:

Mr Jean-Loic KNEUR, CoNRS

Mr Jean ORLOFF, CNU

Observers

AERES scientific representative:

Mr Jean-Michel ROBBE

CNRS representative:

Mr Patricio LEBOEUF, MPPU

University representative:

Mr Marc RABAUD, Directeur UFR de Physique

Evaluation report

1 • Short presentation of the research unit

- Laboratory members including researchers with teaching duties and full time researchers: 24 + 6 emeriti; engineers: 2; PhD students: 17; technicians and administrative assistants: 8
- HDR: 14 + 6 emeriti; HDR who are PhD students avisors: 16
- PhD students who have obtained their PhD during the past 4 years: 20; average lenght of a PhD: 40 months
- PhD students currently present in the research unit: 17; PhD students with fellowships: 17
- Laboratory members who have been granted a PEDR 3
- Publishing laboratory members: 24+ 6 emeriti

2 • Preparation and execution of the visit

The Comité d'évaluation du LPT visited the LPT on December 1st and 2nd.

After a short welcome and presentation by the Director of the laboratory, the Committee has listened to oral presentations on the research activities carried out in the laboratory: Particle physics (Standard Model and Beyond the Standard Model), Mathematical Physics, Cosmology and Statistical Physics. Subgroups of the Commitee have then met with the members of the different research teams.

The Committee has then met the PhD students, the administrative and technical staff, the 'conseil de laboratoire', and the director of the laboratory. The Committee has then met in a closed session to prepare the evaluation report . The meeting was declared closed at 5pm.

All material presented to the Committee was of excellent quality and so was the organization of the day: the atmosphere was optimal and allowed the Committee to work with maximum effectiveness.

3 • Overall evaluation of the scientific activity of the research unit

The LPT Orsay is an outstanding research center, which conducts scientific research at the top international level in a broad range of theoretical directions.

During the last four years, the LPT has obtained major scientific results in all research areas in which it is engaged. Notable examples are: (i) The LPT plays a central role in the computation of the phenomenological effects of the hypothetical theories that attempt to go beyond the current particle-physics Standard Model. As the Large Hadron Collider (LHC) is starting to be operational operational in Genève and might soon test these speculative theories, the LPT team is recognized among the most reliable and trusted sources of tentative phenomenological predictions from these theories. (ii) The extensive exploration of neutrino phenomenology beyond the standard model. (iii) The role that the LPT has assumed in the Planck space mission, among the most exciting and promising projects in frontier physics. This role gives the LPT a strategic position for exploiting the expected scientific output of the mission. (iv) The rigorous calculation of the probability distribution for large-number--of-sides cells in 2d Voronoi cellular complexes is an acclaimed result in

statistical physics, which has received wide international attention. (v) The development of a research line on complex systems, and in particular on networks, has opened new directions of investigation and has received much attention even outside the research world. (vi) The renormalization of the Grosse-Wulkenhaar model, and in particular the discovery of the finite flow between the bare and renormalized coupling constants of the model, is a result that opens the way to the study of quantum field theories different from ordinary ones, with possible applications to major open scientific problems, such as the quantization of gravity. These results have been recognized by numerous prizes and other recognitions. Among these: the CNRS silver medal, the Leverhulme Trust Award, the Aniuta Winter-Klein Grand Prix of the Académie des Sciences, the first Prix Ahmed Badeeb, plenary-speaker invitations to major international conferences, such as STATPHYS23, a high number of scientific publications in top level scientific publications such as PRL. These results place the LPT at the crossroad of some of the most vital and important nodes of contemporary frontier science, such as the microphysics exploration of the LHC, the exploration of the cosmos with Planck, the major theoretical challenge of quantum gravity, or the extension of the tools of theoretical physics to increasingly larger classes of complex systems.

Such a remarkable ensemble of scientific achievements is due to a number of outstanding scientific personalities in the LPT, some in the middle of their career and some brilliant younger scientists; but it is rooted in the rich, vital and diversified scientific environment that the laboratory provides. The scientific policy of the LPT has constantly been guided by the effort to maintain a high level theoretical laboratory with a wide spectrum, where major lines of development of theoretical physics could meet. The committee judges that this richness and diversity is a precious resource that must be defended.

The scientific vitality of the laboratory is also evident from indicators like the high number of grants obtained by the lab (nine ANR contracts and six European contracts currently), the constant flow of visitors, the increasing number of postdocs and doctoral students, the large number of workshops and conferences organized in Orsay, the number and the quality of the students, postdoc and younger scientists that have passed by Orsay on their way to other French and international institutions. In short, the LPT represents a major resource for theoretical physics, for France and the world. This resource deserves to be preserved and expanded.

About a quarter of the LPT researchers retired in the last four years. Several of the retired people continue to make important contributions to the scientific production of the laboratory. But the current high scientific quality is especially the result of a wise thematic renewal that has accompanied a generation change in the laboratory. Many of the major results, and the topics where the LPT appears to be particularly vital, attract students, raise attention and increase its external scientific impact, are in research directions that are new in the laboratory, or that have been opened thanks to recent recruitments.

The LPT has also suffered from a large number of departures in the recent years, including in its excellence sectors, such as for instance in complex systems, and possibly, as was announced shortly before the committee visit, in the Planck group. A strength and a challenge for several or the LPT research groups is that they have attracted gifted researchers on rising career trajectories who have been lured away by exceptional opportunities elsewhere, both in the Paris region and elsewhere. Because of the combined effect of retirement and departures the laboratory has undergone a profound mutation in the last four years. The committee does not judge that the departures should be seen as failures of the LPT. What is important is that good science is done, not where it is done. The LPT has been able to nourish and develop these research lines, and this fact retains its value even if the lines then develop elsewhere. This is a considerable service to French and international physics, and the examples may well make the LPT an attractive destination to other rising stars. The committee appreciates how well the laboratory has started to face this peculiar situation. The departures have been partly compensated by the successful recruitment or moving in of top class researchers. The limited number of openings cannot instantaneously cope with the drop, and compensating recruitment should continue with a high priority for this laboratory over the next four years. Still, an effort of stabilization should help preserve the scientific coherence of the laboratory, and diffuse the risk of dissolution presented by the high mobility. It is worth considering, from a global perspective, what might be done in the future to create within the LPT opportunities equivalent to those that have lured good scientists away.

To this purpose, and in order to maximize the strong potential of the laboratory, the committee believes that the best scientific policy should be to recognize the true areas of excellence in the laboratory and give these adequate space. Reticence in recognizing excellence, maybe in the name of an excessive attention for equality or equilibrium, may be misleading in this context. The committee remarks for example that the “self-

evaluation" in the "activity report", fails even to point out the actual important scientific achievements of the laboratory, and insists only on the French and international "connections" of the laboratory, and on the policy of "keeping the equilibrium". To be inserted into French or international networks is a tool, not an achievement. The committee invites the laboratory not to view the future too much as a prolongation of the past, but rather to give space to the novel excellencies the laboratory has been capable to develop or attract. The committee recommends a strong leadership, and the identification of suitable leading scientists, which could stabilize the difference sectors. Individual research lines should of course not be discouraged, since the best leader for a theoretical physicist is him/herself and the very vitality and the added value of a wide-spectrum theoretical laboratory like the LPT is precisely in the variety of the physics developed; but the objective of preserving the precious character of a top class wide-spectrum laboratory is best achieved by building on the top scientists today in the laboratory and their initiative, rather than in an attempt to keep every tradition alive. The committee sees numerous positive signs in this direction, and encourages the laboratory to pursue this evolution.

4 • Evaluation of the individual research groups

Mathematical physics :

The Mathematical Physics group at LPT has been one of the founding poles of non-commutative geometry. The main current themes of research are related to non-commutative geometry and quantum field theory on non-commutative spaces. These topics are in the focus of current interest among numerous research areas, and touch upon the frontiers of research in mathematics as well as theoretical physics. The Mathematical Physics group at LPT is carrying out research at the forefront of these areas at worldwide scale.

The central issue in non-commutative field theory is to rigorously construct interacting quantum field theory on non-commutative geometries. The group has obtained remarkable achievements in this field. Within a short time-span, it has been able to combine a world-class expertise on constructive quantum field theory, with new methods from non-commutative field theory, partly in collaboration with experts from other parts of Europe, and has become a leading group in the area. Its results over the past few years are to be counted among the most substantial contributions to non-commutative quantum field theory. Among these, notable is the solution of the Grosse-Wulkenhaar model, based on the discovery of a bounded flow between bare and renormalized coupling constants. The model has neither asymptotic freedom, nor a Gaussian fixed point, but rather realizes the idea of asymptotic safety in four dimensions. The interest of the result is that it unveils a possible behavior of a quantum field theory, different from that of ordinary quantum field theories. The PhD students working on these topics present already significant publication records and have, in a short time, become well-known in the research area.

These results have been partially extended to gauge theories on Moyal spaces, and the research is lively in this direction.

The group is also working on general types of non-commutative geometries and their applications in various areas of physics, including the Quantum Hall effect. The group has a highly developed expertise in this area. A recent monograph on (co-)homologies was published by one of its members.

On the more mathematical side, the group is continuing its analysis of the mathematical basis of non-commutative geometry, where substantial results have been obtained in the classification of non-commutative manifolds.

The group is developing an interest in quantum gravity. It has established contacts with experts working in loop quantum gravity, and one of its main objectives for the coming years is to rigorously study the renormalizability of background-independent quantum-gravity models appeared in this context. While this program is certainly ambitious, it is also well thought, attractive and promising, in view of the expertise that the group has in the area of constructive quantum field theory, and in dealing with non-standard theories. Substantial progress on some deep-lying dynamical questions of quantum gravity, via the route that the group is planning to proceed, is possible, and worth pursuing. This research direction could also bring insight into

questions of highly complex dynamics, particularly the question how complex dynamical quantum systems can be interpreted geometrically, in areas other than quantum gravity.

This line of research is novel, and at present not tightly linked to the other activities of the group. The development of a research line in Quantum Gravity should not interfere with these activities; the LPT environment is obviously ample enough for including several lines of investigation in mathematical physics, and the diversity is a source of richness in this context. The numerous connections that already exist between loop quantum gravity and non-commutative geometry, and the common culture of the members of the group, provide a largely sufficient assurance that scientific collaboration is always possible, if and when it becomes possible and scientifically appropriate.

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+	Non noté	A+

Statistical Physics :

The Statistical Physics group covers a broad spectrum of topics, from fundamental aspects to large-scale numerical simulations and new applications of Statistical Mechanics. The traditional strength of the group is in the theory and simulation of strongly correlated classical and quantum fluids, in particular Coulombic and dipolar fluids. Innovative results have been obtained on the liquid-vapor transition of ionic solutions, on a novel field-theoretic approach to classical fluids, on partially ionized quantum plasmas and on the self-assembly of dipolar particles, a cutting-edge subject pioneered by the LPT group.

The interests of the group have recently moved into new, innovative directions. The work on the random geometry of Voronoi cells, with applications to foams and cellular textures, has earned international acclaim. There is also some excellent work on non-equilibrium dynamics in disordered and dissipative media, relying on new developments in exact renormalization group methods and numerical simulations going beyond traditional mean field approximations. Specific studies are for instance on the dynamics of pinned elastic lines (with applications to wetting) and aging properties at a disordered critical point.

Among new applications of statistical mechanics, a new direction that stands out is the dynamics of complex networks. The group has studied complex networks from both fundamental and applied interdisciplinary aspects, with applications to diverse contexts ranging from sociophysics to epidemiology or the understanding of Internet's structure. These works have received wide attention by the scientific world and also by non-scientific press. Another new application of statistical mechanics is the study of the traffic flow based on statistical data analysis and on cellular automata simulations. There is also some excellent applied simulation work on absorption of CO2 and H2 in porous media, with storage implications.

The project for the coming four-year period builds on these achievements, and on the network of national and international collaborations. One ANR-supported project on self-propelling "particles" and two-lane traffic will start in 2009. Another proposal, addressing the statistics of correlated random variables, with applications to non-ideal Brownian motion, is to be submitted to ANR. An international collaboration will investigate the influence of quantum fluctuations at finite temperature on van der Waals interactions and the Casimir effect between charged objects, while work on nano-scale aggregation of polar particles will be pursued in collaboration with experimental groups. Further progress is expected on the non-perturbative renormalization group approach to homogeneous and inhomogeneous fluids.

The group is well equipped to tackle these timely and difficult problems. Its international visibility and recognition are excellent. Enhanced collaboration between group members and a more active recruitment effort of PhD students are to be strongly encouraged.

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A	A+	A	A	A

Cosmology and Gravitation :

The cosmology and gravitation group is a well-established group even though it is the the smallest and youngest of the 5 groups in the laboratory. Each one of the 4 members is a recognized physicist with well defined and promising research projects. On the gravitation side, the study of extensions of general relativity in different dimensions, the physical interpretation of Hawking's radiation and its potential observation in analogous condensed matter systems are timely and well founded subjects of research, as well as the proofs of general instabilities, first for massive spin 2 systems in 4-dimensions and second of the self-accelerating branch of the DGP (Dvali-Gabaddaze-Porrati) model. This is particularly interesting since there have been several experiments designed to test this model and this instability makes this model much less appealing to be subject to experimental tests.

The key project presented by the group is the serious involvement in the PLANCK satellite experiment that will be the main experiment of the next few years studying the density perturbations of the cosmic microwave background. Two of the members of the group have major roles in this experiment (which is remarkable for a small theory group) in the general study of data analysis and comparison with cosmological inflation as well as the study of non-gaussianities, one of the main new results expected from PLANCK.

The committee learned during the visit that one of the members of the group received an offer to join the neighbor APC (Astro-Particle and Cosmology) laboratory from Paris VII University which the panel understands was accepted on a part-time basis. This will have implications in the development of the group with some positive and some negative consequences. On the negative side the group will be partly reduced on the day to day work since the investigator will share his time between the two institutions. On the positive side, the group will enhance its presence in PLANCK since APC has a major participation on the project and will also strengthen the link between the two institutions with positive outcomes for research projects, post-doctoral fellows and PhD students.

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

Particle physics :

The theoretical research in Particle Physics at the LPT is organized into two groups with close scientific relations and overlapping scientific interests, designated as the ``Standard Model Group" and the ``Beyond the Standard Model Group". Taken together, the two LPT groups represent the broadest range of phenomenological research in France, and a notable collection of interests and talent on the world scene. An admirable quality of the LPT team in particle theory has been its capacity to attract promising young people and outstanding visitors, and to build over many years an intellectual community that extends throughout Europe and beyond. An Orsay experience has been part of the formation of many noted researchers. The laboratory serves in many ways as a resource for experimental and theoretical particle physics in the Paris

region. One noteworthy contribution has been the laboratory's sustained record of attracting world-leading senior visitors, including in recent years two holders of the prestigious Blaise Pascal chair.

There is a coherence among the scientific programs of the two groups, but a difference in the outlook, or animating spirit of the research programs. At the risk of oversimplifying, we might say that the Standard Model Group focuses on understanding and explaining what is, whereas the Beyond the Standard Model Group is dedicated to exploring what might be. Both groups exhibit high degrees of originality and appropriate mixtures of calculations from first principles and modeling, and both have produced influential results. The existing structure has worked well, and we see no reason to recommend a change.

1. Standard Model :

Two main thrusts of the Standard Model Group are the study and application of quantum chromodynamics, the theory of strong interactions, especially using lattice regularization techniques, and the investigation of topics in flavor physics. In both areas, LPT researchers are essential members of international networks. The problems they tackle are timely and important and the results they are producing are regarded as significant on the world scene.

The LPT is a vital element of the European Twisted Mass Collaboration, one of about a half dozen powerful lattice QCD collectives in the world. Using the purpose-built architecture of two dedicated APE-Next machines, members of the ETMC pool ensembles of gauge configurations (including the effects of dynamical quarks) and undertake individual analyses addressing specific physics topics. LPT theorists have produced notable results with two flavors of light (*u, d*) quarks and are leaders in incorporating the effects of four flavors (*u, d, s, c*) of dynamical quarks.

The LPT is the main French node of the European flavor physics network, *Flavianet*, which fosters dialogue between theory and experiment on kaon, charm, and beauty physics. The aim here is to extract parameters of the standard model that concern quark mixing and CP violation; the challenge is that the connection between the parameters of interest and the observables involves hadronic physics in the realm in which the strong interactions must be treated nonperturbatively. Recent contributions include the interplay between chiral field theory and lattice methods, investigations of the extraction of pseudoscalar decay constants, and studies of the conditions under which quark-hadron duality is trustworthy.

LPT theorists are involved in many phenomenological studies of immediate relevance to experiment, using modern tools of field theory, including new inventions (such as soft-collinear effective theory) to control perturbative calculations for both inclusive and exclusive reactions. They are well-placed to contribute to the understanding of forthcoming results from the BESS-3, LHCb, ALICE, and Super-B-factory experiments.

On a more theoretical side (and in fact already beyond the Standard Model), interesting results in Yang-Mills theories with *N=4* supersymetries have been obtained following the correspondence between anti-de Sitter and conformal field theories (AdS/CFT), in particular on the duality between planar gluon amplitudes and light-like Wilson loops.

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A	A	A+	A	A

2. Beyond the Standard Model :

The Beyond the Standard Model Group is recognized worldwide as a center for theoretical studies that guide, and help to interpret, searches for new physics, particularly concerning supersymmetry and extra spacetime

dimensions. Members have contributed extensively to preparing the ground for experiments at the Large Hadron Collider and to developing the scientific case for a future electron-positron linear collider.

LPT theorists rank among a few groups of world experts on the Higgs boson, both in the standard model and in the minimal supersymmetric extension to the standard model. The search for this particle, or set of particles, will be one of the signature investigations at CERN's Large Hadron Collider, and the LPT articles and computational codes are essential references. The LPT has excellent contacts with experimental nearby LAL group.

The search for supersymmetric particles is one key line of investigation at the Tevatron and the LHC. Work at LPT has developed a systematic generalization of the simplest supersymmetric extension of the standard model, the next-to-minimal supersymmetric standard model, and laid out possible patterns of particles and their decays. A particular focus is the possibility that the lightest supersymmetric particle might be a candidate for (some of) the dark matter of the universe; this idea has been elaborated in detail, taking account of astrocosmological evidence, collider searches, and direct and indirect detection methods.

The observation that neutrino flavors mix implies that neutrinos have mass, and this is a key experimental evidence for physics not contained in the standard model. LPT theorists have investigated model mechanisms for the generation of neutrino mass, and have pursued the suggestion that a lepton-number asymmetry set early in the evolution of the universe might lie at the origin of the observed dominance of baryons over antibaryons in the current universe.

Every member of the group has at least one doctorant.

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A+	A+	A+	A+	A+

5 • Evaluation of the resources and the life of the research unit

– Direction :

The committee recognizes and congratulates the excellent work of the present director of the LPT. The laboratory appears to works effectively and smoothly in all aspects of its life. Difficulties pointed out in previous evaluation reports have been resolved or diffused.

This achievement becomes particularly remarkable when noticing that the director is among the top scientists of the laboratory, and has obtained acclaimed scientific results during his tenure as director.

In this regard, the committee points out a possible serious crisis in the LPT, and the need for an urgent solution. The director has accepted his present position under an agreement of a 2/3 teaching-release from the University. This solution is obviously an essential ingredient for the very effective direction of the lab combined with the top-class excellence of the scientific production of the director. The committee understands that a new University internal regulation might jeopardize this agreement, and the University might disallow its engagement towards the director. The committee strongly hopes that this will not happen, and registers the goodwill in this way expressed during the meeting with the Direction of the Physics Department and the Vice-Presidency for Research of the University.

- Administration :

The administration appears to be dedicated, efficient, and well organized. LPT researchers enjoy a high level of service from the laboratory administration, which the committee believes should be preserved. The only serious need is in cleaning, where the present staff is insufficient. The committee registers also, and supports, the request of a replacement of the finance responsible, which is departing.

- Finances :

In the new research financing system which is in place in France, the scientific vitality of the LPT has had the effect of largely increasing the financial means of the laboratory, thanks to the large number of contracts obtained. The financial health of the lab is excellent.

- Outreach :

The LPT has a very laudable outreach and communication activity, which the committee strongly encourages to continue.

- Long-term planning :

The large means planned for the development of the site of the University Paris Sud represent an obvious opportunity that the laboratory should not miss. The committee encourages the continuation of the discussion on the best possibility of taking advantage of this opportunity. The idea, recently circulated, of a common building for theoretical physics labs, possibly in the formal context of a "Institut de Physique Th´eorique d'Orsay", providing a good research environment meeting international standard and including facilities for visitors and infrastructure for meetings, appears very attractive, and particularly suitable for a laboratory which is a strong magnetic pole for international visitors and conferences.

- Researcher promotions :

The committee registers the strong unhappiness of some members of the laboratory for the lack of career advancements. To discriminate against scientists on an age basis and stopping the career advancement of very good scientists has a substantial negative effect on scientific production.

- Staff promotions :

The committee notices the absence of a promotion among the laboratory technical and administrative staff for the last ten years, and considers this delay excessive.

- Group leaders :

According to the AERES guidelines, each research group must have a well-identified group leader. ("Les équipes doivent être identifiées par le porteur du projet", Carnet de visite Vague D.) The committee strongly recommends that the LPT identifies a leader for each of the research groups (or subgroups). The reason is not to only comply with an administrative requirement, but also for the scientific reasons discussed above.

- Emeriti :

The fertile ground of the LPT is the precious heritage of a previous generation of world-class physicists and mathematicians, some of whom are still very active and vital and represent a valuable resource of the laboratory. The committee appreciates the search of the difficult balance between the well deserved recognition of the value and role of the senior members of the laboratory, and the need to open space for younger personalities, new ideas and new research directions. The committee encourages the direction to continue the search of the most effective balance.

- Atmosphere :

The committee has been impressed by the very positive atmosphere in the laboratory. A remarkable “good spirit” of collaboration appears to be strong, including among students and the administrative staff.

- Teaching :

The committee registers and congratulates the engagement in teaching and course developing of university members of the laboratory. It also registers the teaching activities of some CNRS members. Advanced teaching has an essential scientific value for communicating and disseminating the basic laboratory ideas and knowledge, and the committee encourages the development of this activity.

- University involvement :

The evolution of the organization of the research in France demands that the members of the LPT seek a far more active involvement in the University, if they do not want to remain marginalized and miss opportunities. University members of the LPT are scarcely involved in the administration of the University. The scarcity of LPT members in key University committees has strong and obvious negative consequences for the laboratory, especially on hiring. A more active involvement is essential if the laboratory wants to develop.

More in general, the committee has the impression of a lack of communication between the University and the LPT. For instance, numerous members of the LPT were under the impression that an old physics-department policy of discouraging applications for CNRS delegations were still in place; a fact lively denied by the current director of the physics department. Given the current evolution of the structure of the French research, it is essential that the laboratory finds a closer relation, better communication and better relations with the University.

- BQR :

In particular, the committee understands from the University representatives that theoretical physics is characterized by the small number of requests for BQR positions. This is a self-inflicted damage, given that the University policy is to reserve 1/3 of new positions to the BQR. The committee invites the lab to make better use of this resource.

- Scientific policy :

The committee understands that the “Commission des Specialistes”, and a peculiar new body,put in place in Orsay to continue these Commissions under the novel University regulations, plays an important role in the allocation of positions in physics among the different laboratories of the University. This role of the “Commission des Specialistes” is unusual and, as far as the committee can see, illegitimate. It has apparently lead to a uniform rotation of openings between laboratories. The committee understands from the meeting with the university representatives that this result is also considered suspicious by the University administration itself. This system has been rather unfavorable to the LPT, because it does not take into account the top-class scientific excellence of the LPT, the number of the retirements, the size of the lab, and the vitality of the scientific projects. The committee invites the direction of the lab to find a better dialog with the University hierarchy, and take more direct role in the establishment of the scientific policy of the University. Avoiding this “rotation” system is a way to exploit and reward the outstanding LPT excellence, to be flexible to grasp opportunities when they appear, and to maximize the effectiveness of the governance of the laboratory.

6 • Recommendations and advices

– Strong points :

The LPT is among the very best French laboratories in theoretical-physics. It brings together a wide range of research directions. These have numerous points of contact, providing a rich terrain for exchanges and cross-fertilization. The laboratory includes several world-class scientific personalities, that represent the excellence in their respective domains. It has wide international visibility.

The committee appreciates the soundness of the scientific directions investigated and also the resistance of the laboratory against fashions in research directions. Risks in frontier research are taken, but with well-thought scientific motivations and justified by the presence of specific competencies, opportunities, and ideas.

– Weak points :

An effort of stabilization should help preserve the scientific coherence of the laboratory, and diffuse the risk of dissolution presented by the high mobility. The committee invites the laboratory not to view the future too much as a prolongation of the past, but rather to identify and build on the initiative and ideas of the new scientific excellencies the laboratory has been capable to develop or attract. The committee recommends a strong leadership, and the identification of a leading scientist for each sector, which could stabilize the difference sectors.

– Recommendations :

The committee judges favorably and supports the scientific project presented by the laboratory, including the recruitment plan. In the documents presented to the committee, the LPT presents two strongly motivated and well argued research directions: on quantum gravity in mathematical physics and on the PLANCK mission in cosmology. The other part of the project is less specific, and more centered in the continuation of what is being done.

- Mathematical Physics :

The committee strongly supports the Quantum Gravity project proposed by the Mathematical Physics group. First, because of the major scientific stature of the proponent and second because of the convincing motivation of the project itself. The LPT has a specific expertise, well recognized and unique in the world; this expertise is today required by the recent development in quantum gravity and the LPT is perfectly placed to address this major issue. Quantum gravity is perhaps the major theoretical problem at the core of today's physics, and deserves to be investigated in the LPT. The project has been well prepared by an intense program of visits, and exchanges of postdocs and students. The committee acknowledges the current effort of the group to build in this direction, for instance with an ANR project. The committee recommends that a position be allocated to this project at the earliest. If the effort grows positively, a second position can be considered in a second stage, perhaps at the CR1 level.

This project should not interfere with the research direction being currently followed by other members of the group, who are encouraged to pursue their valuable research programs. An intersection between the two research lines is certainly possible and could mature naturally.

The lack of a CR to DR promotion is felt particularly strongly in this group.

- Gravitation and Cosmology :

The PLANCK project is relevant and fully convincing. The PLANCK space mission is one of the most exciting international frontier experiences, and it raises strong expectations. Not only the LPT has currently a major position within the PLANCK collaboration, but it is also in a strategic position, being in charge of the data analysis for a key sector of the mission. Therefore in principle the committee would fully support this project, and the associated request of a recruitment to strengthen the PLANCK group.

However, as mentioned above, the committee understands that shortly before the evaluation visit, the principal leader of the project has announced his intention of move part of his activity to the APC laboratory in Paris. This very recent development opens the questions of the opportunity of a full investment in this direction, especially since PLANCK recruitment were at least partly argued to balance the movement of many cosmologists towards APC. The news is recent and the best strategy is probably a period of reflection, also in consideration of the recent recruitment in this group. Keeping a strong tie with the APC and collaborate on PLANCK could be a very good option. Further recruitments as temporary step towards moves elsewhere are obviously not a good strategy.

Even if the LPT ends up judging that the Planck project is not to remain the priority, the committee supports the development of a cosmology group at LPT, and thinks that the group needs to be strengthened. There are various possibilities for doing so. A natural possibility is to hire a researcher with background on the density perturbations of the cosmic background, as relevant for the PLANCK project, but also with expertise in other areas of cosmology such as dark matter, baryogenesis and inflation; this could create a link with the BSM group. A second one, is given by the current interest of the group in quantum gravity, and in particular on Lorentz invariance violations: there is an obvious scientific convergence with the development of a research line in Quantum Gravity in the Mathematical Physics group, and the committee encourages a constructive dialog between the two groups in order to explore possible common developments.

- Statistics :

The group has recently been depleted by the departure of three relatively young and very active members, so that some restructuring of research topics may be useful. The hiring plan presented by the LPT in this area is not very specific. The recruitment of a junior researcher would be welcome to bring the group back to full strength, but the committee judges that an additional development in this direction should first require a period of reflection about a clear line of development to be singled out.

A natural possibility to reinforce the group suggested during the evaluation visit is via a transfer to the LPT of a close collaborator already present de facto in the laboratory. The committee supports this solution.

- Particles :

The strength of the particle sector of the LPT is the wide and nearly continuous spectrum of competencies, within and beyond the Standard Model. This is a precious resource that deserves to be preserved and extended by recruitment in the coming years.

Besides the aim of keeping a central role in the interpretation of the data that may emerge from LHC (and eventually the ILC), the committee judges very positively also the other projects of the group, including the attention towards a more theoretical model-building activity, and the possibility (already mentioned above) of developing links with the “Gravitation and Cosmology” group through inflation and density perturbations, or neutrino physics.

The Standard Model group has been particularly hit by the recent wave of retirements and transitions to emeritus status. The committee judges that the continuation of the rebuilding of the Standard Model sector of the particle group should continue with high priority. While a number of the nominally retired people continue to make valuable contributions to research and to the intellectual life of the laboratory, effective stewardship may call for special attention to recruiting new members who can sustain and help guide the evolution of this traditionally strong research sector.

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

UNIVERSITÉ
PARIS-SUD 11

Le Président de l'Université Paris-Sud 11

à

Monsieur Pierre GLORIEUX
Directeur de la section des unités de recherche
AERES
20, rue Vivienne
75002 Paris

Orsay, le 20 mars 2009.

N/Réf. : 68/09/GCo/LM/LS

Objet : Rapport d'évaluation d'unité de recherche
N° S2100012362

Monsieur le Directeur,

Vous m'avez transmis le deux mars dernier, le rapport d'évaluation de l'unité de recherche « Laboratoire de Physique Théorique » - LPT – UMR 8627, et je vous en remercie.

L'université prend bonne note de l'appréciation et des suggestions faites par le Comité.

Les points à améliorer seront discutés avec le directeur d'unité dans un esprit constructif pour l'avenir de la recherche à l'université.

Vous trouverez en annexe les éléments de réponse de monsieur Henrik HILHORST, Directeur de l'unité de recherche.

Je vous prie d'agréer, Monsieur le Directeur, l'expression de ma sincère considération.

Guy COURRAZE
Président

P.S. : Les représentants de l'université lors de cette visite étaient Mr Jacques BITTOUN – Vice-président du Conseil Scientifique et Mr Marc RABAUD – Président du Département Physique de l'UFR Sciences.

P.J. : Commentaires de Mr HILHORST

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Réponse du Laboratoire de Physique Théorique (UMR 8627)
au rapport de la commission d'évaluation de l'AERES (janvier 2009).

Le Laboratoire de Physique Théorique d'Orsay est fort satisfait de l'appréciation élogieuse portée sur son travail par le prestigieux comité d'évaluation de l'AERES.

Le LPT souhaite souligner que son projet 2010-2013 comporte plusieurs volets d'importance comparable, conçus pour appliquer l'expertise très diversifiée du laboratoire aux grands enjeux de la physique contemporaine. Ainsi, à côté de la gravité quantique, que le rapport de l'AERES fait ressortir, la physique au-delà du Modèle Standard et la partie "géométrie non commutative" de la physique mathématique sont également très présentes dans la vision que le LPT a de son futur.

Une correction factuelle mineure:

Le livre de Th. Masson, mentionné en section 4, porte sur les (co-)homologies (et non sur la géométrie non commutative). Dans cette section 4, au quatrième paragraphe, la dernière phrase serait donc mieux formulée comme suit : "The group has a highly developed expertise in this area. A recent monograph on (co-)homologies was published by one of its members."

H.J. Hilhorst
Directeur du LPT