

**Research evaluation** 

# EVALUATION REPORT OF THE UNIT LPTMS - Laboratoire de physique théorique et modèles statistiques

UNDER THE SUPERVISION OF THE FOLLOWING ESTABLISHMENTS AND ORGANISMS: Université Paris-Saclay Centre national de la recherche scientifique -CNRS

# **EVALUATION CAMPAIGN 2024-2025** GROUP E

Rapport publié le 30/04/2025



# In the name of the expert committee :

Malte Henkel, chairman of the committee

For the Hcéres :

Coralie Chevalier, president

In accordance with articles R. 114-15 and R. 114-10 of the Research Code, the evaluation reports drawn up by the expert committees are signed by the chairmen of these committees and countersigned by the president of Hcéres.



To make the document easier to read, the names used in this report to designate functions, professions or responsibilities (expert, researcher, teacher-researcher, professor, lecturer, engineer, technician, director, doctoral student, etc.) are used in a generic sense and have a neutral value.

This report is the result of the unit's evaluation by the expert committee, the composition of which is specified below. The appreciations it contains are the expression of the independent and collegial deliberation of this committee. The numbers in this report are the certified exact data extracted from the deposited files by the supervising body on behalf of the unit.

# MEMBERS OF THE EXPERT COMMITTEE

Chairperson:	M. Malte Henkel, Université de Lorraine, Vandœuvre-lès-Nancy
Experts:	M. Frédéric Chevy, École normale supérieure - PSL Mme Leticia Cugliandolo, Sorbonne Université (représentante du CoNRS) M. Manoel Manghi, Université Toulouse 3 - Paul Sabatier (représentant du CNU)

# HCÉRES REPRESENTATIVE

Mme Annette Calisti Mme Laurence Pruvost

## REPRESENTATIVES OF SUPERVISING INSTITUTIONS AND BODIES

M. Etienne Augé, Vice-président Recherche de l'Université Paris-Saclay

M. Bertrand Georgeot, Directeur adjoint scientifique du CNRS

M. Denis Merlet, Doyen de la faculté des sciences d'Orsay



# CHARACTERISATION OF THE UNIT

- Name: Laboratoire de physique théorique et modèles statistiques
- Acronym: LPTMS
- Label and number: UMR 8626
- Number of teams: 3
- Composition of the executive team: M. Alberto ROSSO (directeur) et Mme Claudine Le Vaou (responsable administrative)

## SCIENTIFIC PANELS OF THE UNIT

ST Sciences et technologies

ST2 Physique

### THEMES OF THE UNIT

Research at the LPTMS strives at modelling, to understand qualitatively and to describe quantitatively the complex phenomena which come not only from condensed-matter physics and quantum fluids (in a large sense) but also from topics at the interface with biology, mathematics or even social sciences. The unit is organised into three teams: 1. quantum systems; 2. statistical physics, field-theory and integrable systems; 3. disordered systems, soft matter and physics at the interfaces

### HISTORIC AND GEOGRAPHICAL LOCATION OF THE UNIT

The LPTMS is a joint research unit of CNRS and University Paris-Saclay (UMR 8626) that was established in 1998. Since 2019, it has been located in the new building 530 on the Moulon plateau. The new location offers considerably more space, comfort and facilitates the exchange with nearby laboratories.

## RESEARCH ENVIRONMENT OF THE UNIT

LPTMS is hosted by Paris-Saclay University, one of the world's top universities, and benefits from its facilities.

In the evaluation period, the LPTMS moved from old buildings down in the valley and near the Orsay Centre, to a new research building on the Moulon plateau, which is geographically closer to other research institutions in theoretical physics, notably the IPhT (CEA of Saclay) and CPhT (École polytechnique of Palaiseau).

The new location has several advantages over the old building: it provides a significantly more spacious and comfortable environment, co-hosts the Institut Pascal. It also gives the advantage of spatial proximity with the five other partners in the Federation Friedel Jacquinot. LPTMS was an important member of the Labex PALM (terminated in 2022) and now of the Graduate School of Physics.

Importantly enough, the new building is close to the LPS, with biophysics activity close to the interests of members of the LPTMS, and it is also close to the interdisciplinary computer science laboratory (LISN) with which members of the LPTMS plan to start collaborations.



## UNIT WORKFORCE: in physical persons at 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	3
Maîtres de conférences et assimilés	3
Directeurs de recherche et assimilés	10
Chargés de recherche et assimilés	4
Personnels d'appui à la recherche	3
Sous-total personnels permanents en activité	23
Enseignants-chercheurs et chercheurs non permanents et assimilés	7
Personnels d'appui non permanents	0
Post-doctorants	6
Doctorants	14
Sous-total personnels non permanents en activité	27
Total personnels	50

DISTRIBUTION OF THE UNIT'S PERMANENTS BY EMPLOYER: in physical persons at 31/12/2023. Non-tutorship employers are grouped under the heading 'others'.

Nom de l'employeur	EC	С	PAR
CNRS	0	14	3
U PARIS SACLAY	6	0	0
Total personnels	6	14	3

# **GLOBAL ASSESSMENT**

The LPTMS is a truly world-class theoretical physics unit, with a high volume of top-tier publications produced by its three research teams, averaging nearly four publications per researcher per year.

The members of the LPTMS have secured numerous grants and external funding, including prestigious projects funded by ERC, Fondation Bettencourt and ANR, reflecting the strong research performance of the unit.

The LPTMS has played a crucial role in training researchers. Numerous Ph.D. students have successfully completed their theses, with many continuing their research careers through postdoctoral positions and often continue with permanent academic positions.

Additionally, the unit benefits from robust administrative support and provides high-quality teaching and supervision at the Master's and doctoral levels.



# **DETAILED EVALUATION OF THE UNIT**

# A - CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

Maintain of the present level of research and the quality of recruitment:

The high level of research has been successfully maintained, as evidenced by the consistently high volume of scientific publications (approximately 530), many of which appear in prestigious journals such as Physical Review Letters, Nature, and PNAS.

Between 2019 and 2023, 52 Ph.D. students were trained, and 38 postdocs were recruited. Notably, 11 of the Ph.D. students have already secured permanent academic positions (8 in France), and 12 of the postdocs have also obtained permanent academic positions (4 in France), highlighting a clear success.

#### Maintain the atmosphere and the global coherence:

This has been successfully achieved, partly due to the excellent working conditions, which are also a result of the efforts of the administrative and IT staff. The relatively small size of the unit facilitates the integration of different working styles, leading to 22 joint publications between different teams of LPTMS. Efforts will be made to further increase this collaboration in the future, whenever possible.

#### Continue to be creative and innovative:

This has been successfully addressed. The arrival of new research personnel opened up new directions for research. Additionally, studies on complex landscapes and biological robustness are progressing well beyond the initial objectives and goals.

# B - EVALUATION AREAS

## EVALUATION AREA 1: PROFILE, RESOURCES AND ORGANISATION OF THE UNIT

## Assessment on the scientific objectives of the unit

The scientific aims are both ambitious and of high quality. They are centred on outstanding problems in lowenergy theoretical physics and are structured around three main research axes. Carrying out this research program will likely lead to important conceptual advances and understanding.

### Assessment on the unit's resources

The main resource of a research unit such as the LPTMS is always the outstanding qualities of its scientists. A very high amount of financial support (in excess of 6 M€) has been obtained (including 3 from ERC, Impulscience, Simon Foundation, 16 from ANR, 1 from PEPR, 2 from ITN). Continuous efforts are being made to recruit new permanent members, as some former members have either retired or moved on to prestigious positions at other institutions.

The computer facilities appear to be adequate for the needs of the teams in the LPTMS, with efficient support. Since moving to the new building in 2019, each permanent staff member has been provided with a separate office, while two Ph.D. students or postdocs share an office. The unit is equipped with a high-performance computing cluster, enhancing its research capabilities. This modern infrastructure has significantly increased the unit's attractiveness, contributing to a large number of Ph.D. students and postdocs. Also, the unit benefits from high-quality administrative support, ensuring smooth operations and efficient management.



## Assessment on the functioning of the unit

There is a strong corporate culture among all members, facilitated by weekly seminars with high participation rates, fostering open communication and collaboration. The absence of a rigid hierarchy promotes a productive and inclusive work environment, which is reinforced by a middle size of the LPTMS, which facilitates efficient internal exchange and communication. Additionally, the unit benefits from excellent administrative support, ensuring smooth coordination and efficient management of activities.

## 1/ The unit has set itself relevant scientific objectives.

## Strengths and possibilities linked to the context

LPTMS is distinguished by the exceptional scientific quality of its members. It maintains active collaborations with external units and international institutions, enhancing the scope and impact of its research.

The extensive participation of the LPTMS members in international scientific conferences further underscores its dynamic presence in the global research community and its commitment to the dissemination of knowledge.

### Weaknesses and risks linked to the context

LPTMS successfully navigated two recent challenges: (i) the relocation into its new building in 2019 (ii) the transition to a new direction in 2022.

The committee becomes aware of potential difficulty to recruit young researchers in the surroundings of Paris rather than in the Paris city centre.

# 2/ The unit has resources that are suited to its activity profile and research environment and mobilises them.

#### Strengths and possibilities linked to the context

The main asset of the LPTMS is its outstanding researchers, whose excellence is recognised world-wide. This resource is irreplaceable, and no effort should be spared to maintain it at its current level.

This is complemented by excellent computer facilities, access to scientific information, and substantial financial support from a large number of grants (3 ERC, Impulscience, Simons Foundation, 16 ANR, 1 PEPR, 2 ITN, etc.), amounting to a total of over 6 M€.

### Weaknesses and risks linked to the context

The chief administrator of the LPTMS has done an outstanding job over the years. She has been instrumental to the unit's success, providing essential support to permanent researchers, assisting foreign postdocs with practical matters during their relocation, and guiding Ph.D. students through the doctoral schools. She is set to retire at the end of 2026, and finding a replacement of comparable quality will undoubtedly be a challenge.

## 3/ The unit's practices comply with the rules and directives laid down by its supervisory bodies in terms of human resources management, safety, environment, ethical protocols and protection of data and scientific heritage.

#### Strengths and possibilities linked to the context

LPTMS has been very actively involved in managing larger-scale organisms, for example in EDPIF, CNU, CoNRS, advisory boards of journals, thereby providing valuable service to the scientific community, in France and worldwide.

Members of the LPTMS served as directors of Poncelet (2016–2022), of the Institut Pascal (2018–2023), and as 'vice-doyen' of the Université Paris-Saclay (2022-23). One of them was also recently appointed president of ENS Lyon.

The unit is aware of environmental issues and have started a program that takes account of carbon emissions during missions. To limit their carbon footprint, they have agreed to favour train for journeys shorter than six hours.



#### Weaknesses and risks linked to the context

The Maîtres de Conférences face a lack of promotion opportunities in the foreseeable future, which has the potential to foster a significant sense of frustration. We acknowledge that this is a national issue; however, some universities are attempting to devise innovative solutions.

## EVALUATION AREA 2: ATTRACTIVENESS

#### Assessment on the attractiveness of the unit

The unit demonstrates strong attractiveness, as evidenced by the large number of doctoral students and postdoctoral researchers it hosts, many of whom come from abroad. This appeal is supported by excellent research resources and significant external funding, including projects funded by ANR, ERC grants, IUF memberships, international scholarships, and foundation support. Additionally, the unit is deeply engaged in master's programs and doctoral training initiatives, further reinforcing its role as a hub for advanced scientific research and education.

- 1/ The unit has an attractive scientific reputation and is part of the European research area.
- 2/ The unit is attractive because for the quality of its staff support policy.
- 3/ The unit is attractive through its success in competitive calls for projects.
- 4/ The unit is attractive for the quality of its major equipment and technical skills.

#### Strengths and possibilities linked to the context for the four references above

The LPTMS benefits from the outstanding quality of its scientists, who can work in a congenial atmosphere. They are linked into many collaboration networks and do receive copious financial support (ERC grants, ANR grants, Impulscience, Simon foundation, PEPR, ITN ,...) with a total volume of more than 6 M€. This is also shown by the active organisation of LPTMS members in international and national congresses, workshops and schools. The LPTMS has a long-standing and well-established reputation of excellence. Facilities and excellent administrative services support this.

The quality of LPTMS scientists has been recognised on a national and international level by several prizes (CNRS silver medal, EPS Prize, several attributions of Humboldt foundations or several elections for IUF memberships).

Another sign of appreciation in the scientific community is the attribution of permanent academic positions to former postdocs (14, of whom 4 in France) and former PhD students (13, of whom 8 in France).

Internal promotions, either at CNRS or at the Université Paris-Saclay of several members of LPTMS is another sign of appreciation of the work done by these people.

Much effort is spent by the administrative staff of the LPTMS to help foreign PhD students and postdocs to integrate, notably by helping to find housing and with language classes. In general, much help is provided with the managing of contracts and financial support.

#### Weaknesses and risks linked to the context for the four references above

A highly appreciated administrative staff is bound to retire by the end of 2026. Her replacement will require a conscientious effort.

There have been a couple of departures or retirements of important scientific personnel, which in the case of leave towards another scientific institution is, first of all, a clear sign of appreciation of those colleagues. For these, from the point of view of the LPTMS, adequate replacements should be sought in the forthcoming years.



## Assessment on the scientific production of the unit

The scientific production is continuously strong, with more than 530 articles published in international first-class journals, including Nature, PNAS, PRL, .... This amount to the very high average of more than four publications per year of each scientist. More publications for the next period are already forthcoming. There are also many contributions to conference proceedings (18), book chapters (10) and several books (7)

written by members of the LPTMS.

In addition many congresses and schools have been organised.

- 1/ The scientific production of the unit meets quality criteria.
- 2/ The unit's scientific production is proportionate to its research potential and properly shared out between its personnel.
- 3/ The scientific production of the unit complies with the principles of research integrity, ethics and open science. It complies with the directives applicable in this field.

### Strengths and possibilities linked to the context for the three references above

The scientific output, in journals of the highest standing, is clearly far above with respect to expectations from a unit of this medium size, in both quality and quantity. That medium size of the LPTMS encourages ready and efficient exchanges between the totality of its members, and also with the postdocs and PhD students.

Contact of the research activities of the LPTMS is in particular via Foundation programmes, for instance via the L'Oréal Bettencourt ImpulScience programme, or three ERC grants, which do provide an important financial support.

The LPTMS participates actively in collective outreach activities.

Weaknesses and risks linked to the context for the three references above None.

## EVALUATION AREA 4: CONTRIBUTION OF RESEARCH ACTIVITIES TO SOCIETY

## Assessment on the inclusion of the unit's research in society

This is a research unit on theoretical physics. The aims of its activities strive at deepening the understanding of complex and intricate phenomena. By its nature, this does not lend itself to direct interactions with the private sector. However, the lab maintained the outreach activities that were already highlighted in the previous evaluation.

- 1/ The unit stands out for the quality and the amount of its interactions with the non-academic world.
- 2/ The unit develops products for the cultural, economic and social world.
- 3/ The unit shares its knowledge with the general public and takes part in debates in society.

Strengths and possibilities linked to the context for the three references above

LPTMS members are strongly involved in teaching in the Département de Physique de la Faculté de Sciences de l'Université Paris-Saclay, notably in the master programs.

Several books (7) on statistical mechanics or quantum mechanics outline these activities.



In addition, some members participate in outreach events targeting broader audiences, such as the annual 'Fête de la Science' and LPTMS also host middle-school students for their mandatory discovery internship ('stage de découverte professionnelle de troisième').

Weaknesses and risks linked to the context for the three references above No risk to mention



# **ANALYSIS OF THE UNIT'S TRAJECTORY**

Since its foundation in 1998, the LPTMS has stood as a lighthouse of fundamental research in theoretical physics in France and is world-wide recognised for its excellence and outstanding level. After moving into a new, more spacious and comfortable, building in 2019, there are all prospects that this remarkable development should continue.

Some of the many highlights of the evaluation period include in team 1 the study of weakly interacting Bose gases and the appearance of liquid phases, the realisation of condensates of ultra-cold atoms, non-equilibrium quantum thermodynamics from simulations with circular Rydberg atoms, quantum simulations of many-body systems, experimental studies on quantum tunnelling, acoustic analogues of black holes, tripartite entanglement and especially the novel generalised hydrodynamics pioneered by a member of LPTMS, studies on dynamical correlation functions, open dissipative quantum systems and dissipative localised phases, the deep links with random matrix theory and quantum chaos which might turn out to be essential features of quantum many-body system or quantum scars.

Highlights from teams 2 include long-range interactions and phase transitions in low dimensions, and their relationship with random matrices, on one hand with the eigenvalue theory of those and the consequences for phase transitions of the highly non-trivial 1D Coulomb gas and large deviations and fluctuations and, on the other hand, for quantum gases and quantum statistics, conceptual differences between statistical ensembles, exclusion statistics, the role of random matrices for the understanding of 1D disordered systems, the theory of generalised Lyapounov exponents. The wide range of problems related to polymers in random media and the ubiquitous KPZ universality class further deep links with random matrices. A significant area of study is stochastic resetting, co-invented by a member of the LPTMS, and its myriad applications, foremost but not all exclusively, to search algorithms. Further topics include last-passage times, active particles, percolation clusters and their conformal field-theory description, deep exact studies on open spin chains and their correlation functions, which are also related to certain combinatoric problems.

Work from team 3 includes highlights about glasses and more generally disordered systems and their relation with top-priority topics such as machine learning, the very promising new approach on the use of highdimensional landscapes in many-body localisation, dynamical systems developing avalanches, systems with long-ranged interaction and the theory of the Wigner bi-layer. A very applied direction is interested in the physics of cement cohesion. An amusing mathematical digression treats Borwein integrals. Finally, a long-time project focusses on the emergence of macroscopic active processes in the cytoskeleton, self-assembly of geometrically frustrated objects and more generally on the physics of living organisms and their robustness against biological and environmental fluctuations. Cross-disciplinary themes include the interplay between thermal and quantum fluctuations, the so-called 'mean-field games' with deep links to the non-linear Schrödinger equation, crowd and epidemic dynamics and mathematical game theory.

On an international scale, it is normal that there should be some fluctuations of the permanent members of a well-recognised research unit. It is a clear signal of world-wide appreciation that such fluctuations occur in the LPTMS. But it also implies that a continuous watchfulness is required from the direction to find adequate replacements for departures and thereby to contribute to the continuous rejuvenation of the research activities.

World-wide contacts are also maintained by actively recruiting foreign doctoral students and postdocs. The direction and administrative staff pursue a laudable policy of integration of these which does require much active help, especially for housing.

The above schematic thematic list, which cannot do justice to the overwhelming variety of topics actively treated, by a unit of only medium size, gives an *aperçu* of past achievements and what might be expected in the near future. Given the very active minds involved, one thing to 'expect' is new surprises and fresh ideas. From the topics mentioned, existing intensive collaboration between the three teams of LPTMS is evident. The LPTMS has many existing and active collaborations with experimental groups and this should continue. In total, one has all conceivable guarantees of an interactive and stimulative research environment which will help to prepare, by the conceptual clarifications of fundamental research, the technological developments of tomorrow. The LPTMS has all the ingredients to stay an active and foremost participant in these developments.



# **RECOMMENDATIONS TO THE UNIT**

# Recommendations regarding the Evaluation Area 1: Profile, Resources and Organisation of the Unit

Following the departure of several important members, develop and follow a policy for their efficient replacement and in this way for a continuing rejuvenation of the research activities.

Be attentive regarding the administrative staff, eventual retirements and maintain it at a well-working level.

## Recommendations regarding the Evaluation Area 2: Attractiveness

Continue to attract outstanding young scientists to work at the LPTMS.

If possible, try to open perspectives for career development for the younger research scientists, in particular for the Maîtres de Conférences at Université Paris-Saclay. The committee recognises that this is a nation-wide problem.

## Recommendations regarding Evaluation Area 3: Scientific Production

Continue in your outstanding research and publication activities, in the several scientific axes developed by the LPTMS.

## Recommendations regarding Evaluation Area 4: Contribution of Research Activities to Society

Continue your active participation in teaching. If possible, try to develop further outreach activities.



# **TEAM-BY-TEAM OR THEME ASSESSMENT**

Team 1:

Quantum Systems

Name of the supervisor: Mr Nicolas Pavloff

# THEMES OF THE TEAM

The quantum systems team is very active and has explored a broad variety of research topics from analogue black holes to generalised hydrodynamics of integrable systems. Its cohesion is strengthened by several collaborations between team members. The report also showcases several examples of fruitful collaborations with experimental groups in Paris Saclay as well as outside (Collège de France, Toulouse, USA, China...)

# CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Strong and long-standing collaborations with experimental groups exists. This cross-fertilisation between experimental and theoretical work is a particular strong point.

# WORKFORCE OF THE TEAM: in physical persons at 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	1
Maîtres de conférences et assimilés	2
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	2
Personnels d'appui à la recherche	0
Sous-total personnels permanents en activité	6
Enseignants-chercheurs et chercheurs non permanents et assimilés	4
Personnels d'appui non permanents	0
Post-doctorants	4
Doctorants	4
Sous-total personnels non permanents en activité	12
Total personnels	18

# EVALUATION

## Overall assessment of the team

The team is very active. Its outstanding national and international visibility is evidenced by the large number of collaborations, especially with experimentalists as well as its large number of publications (157 publications, including 22 Phys. Rev. Lett. and 9 in high impact journals), its capacity to attract funding (more than 2M€ including one ERC grant that was obtained during the evaluated period) and PhD and postdoctoral researchers (14 and 12 respectively).

### Strengths and possibilities linked to the context

While maintaining previously existing lines of research at the highest international level, new recruitment allowed the team to expand its activities towards new domains, including out-of-equilibrium quantum systems and topological effects.



### Weaknesses and risks linked to the context

A significant proportion of the permanent team members hold junior faculty positions (MCF or CR). The current challenges in securing promotion to PR/DR positions could jeopardise the team's long-term ability to retain its most promising members.

#### Analysis of the team's trajectory

The team was strengthened by the addition of two high-profile permanent members, who introduced new research areas and enhanced the team's dynamism.

## **RECOMMENDATIONS TO THE TEAM**

Continue with your excellent research activities.



#### Team 2:

Statistical Physics, field theory and integrable systems

Name of the supervisor: Mr Christophe Texier

# THEMES OF THE TEAM

The team works on the main lines of equilibrium statistical physics (long-range gases and random matrix theory, quantum gas and quantum statistics, exclusion statistics), disordered systems (localisation and products of random matrices, directed polymers in random media and the KPZ universality class, complex landscapes), out-of-equilibrium statistical physics and stochastic processes (resetting, first passage times, active particles) and field-theory and integrable systems (statistical and conformal field theory, spin chains with open boundary conditions, combinatorics and enumeration of random walks).

## CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

There were no recommendations specifically directed at the team.

# WORKFORCE OF THE TEAM: in physical persons at 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	1
Maîtres de conférences et assimilés	0
Directeurs de recherche et assimilés	5
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	0
Sous-total personnels permanents en activité	6
Enseignants-chercheurs et chercheurs non permanents et assimilés	2
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	5
Sous-total personnels non permanents en activité	7
Total personnels	13

# **EVALUATION**

### Overall assessment of the team

A high-quality, excellent team carries out research in an impressively large diversity of directions in statistical physics. This is shown by the outstanding number of high-quality publications (~180, a slight increase over the already outstanding numbers from the last evaluation). Many members of the team are active in international scientific communications (congresses/invited seminars). The team attracts many visitors, from France and abroad. The numbers of postdocs and PhD students are large. Members of the team are implied seriously in teaching, on the level of master and doctoral studies.

#### Strengths and possibilities linked to the context

The quality of the team members is very high. Attracting such individuals to the statistical physics team at LPTMS in such numbers is a clear sign of outstanding quality and reputation, both in France and abroad.

Most of the members are in their scientific prime, which is also beneficial for securing the necessary financial resources to continue executing this highly ambitious program. It is also essential for attracting a large number of doctoral students and postdocs.



## Weaknesses and risks linked to the context

In view of a potential mobility of the team's members, a continuous watchfulness of the team's leader and the direction of the LPTMS must be kept to maintain its present outstanding level.

The recent departures are not all replaced.

#### Analysis of the team's trajectory

In the evaluation period, the team continued to maintain its outstanding level in several areas of research in statistical physics, under the headlines of: equilibrium statistical physics, disordered systems, out-of-equilibrium statistical physics and stochastic processes, field-theory and integrable systems. It is a very lively and active group and so it is part of a normal evolution that there have been departures and retirements, implying well-known researchers. The team is attentive to that and continues in its efforts to recruit new members. This is part of an ongoing rejuvenation. Future research projects look promising.

# RECOMMENDATIONS TO THE TEAM

Continue the excellent work presently carried out, in several directions. It is important to recruit new permanent members to replace recent departures, on a longer time-scale.



#### Team 3:

Disordered systems, soft matter and physics at the interfaces

Name of the supervisor: Mr Silvio Franz

# THEMES OF THE TEAM

This multidisciplinary team works on three main themes which are: (i) Disorder systems and soft matter and specifically on glasses, jamming, dynamic response of disordered materials, many-body localisation, ionic correlations in electrolytes and cement and systems with long ranged interactions. (ii) Physics of living matter in collaboration with experimentalists, focusing on the emergence of active processes in the cytoskeleton and self-assembly of geometrically frustrated objects, reaction-diffusion models and statistical inference techniques to study protein dynamics. (iii) Physics at the interface such as urban climate physics and physiological effects in sports, mean-field games physics, crowd and epidemics dynamics, and Casimir effect in various systems,

# CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

No specific recommendations concerning the team were given in the previous report.

New projects and research fields have been developed, such as high-dimensional disordered systems and robustness in biology, associated to new recruitment of two chargés de recherches (CNRS). Moreover, there are many inter-publications with team 2, which prove the increase in internal collaborations since the last evaluation.

# WORKFORCE OF THE TEAM: in physical persons at 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	1
Maîtres de conférences et assimilés	1
Directeurs de recherche et assimilés	4
Chargés de recherche et assimilés	2
Personnels d'appui à la recherche	0
Sous-total personnels permanents en activité	8
Enseignants-chercheurs et chercheurs non permanents et assimilés	1
Personnels d'appui non permanents	0
Post-doctorants	2
Doctorants	5
Sous-total personnels non permanents en activité	8
Total personnels	16

# EVALUATION

## Overall assessment of the team

The team has achieved outstanding results as evidenced by its numerous publications (171 with 19 multi teams and 29 with high visibility) and grants (around  $4 M \in$ ). Many scientific national and international collaborations have been developed including some being with experimentalists.

Furthermore, its attractiveness is very high since two excellent new researchers have been recruited and 20 postdocs and 24 PhD students worked in this team during the period 2019–2023.



### Strengths and possibilities linked to the context

This team is multidisciplinary, develops statistical physics models that interest many experimental groups. It has therefore a huge number of collaborations in several fields of science (materials, biology, ecosystems, earthquakes, medicine, social science...) and with team 2. The members of the team have therefore obtained many interdisciplinary grants.

#### Weaknesses and risks linked to the context

With the recent departure of two professors of university Paris-Saclay, the team risks having less connections with master students. It is not yet clear to what extent this can be compensated.

#### Analysis of the team's trajectory

The team has grown up during the period 2020–2023 and has expanded the variety of research themes. It has maintained its high level of scientific research. The team presents an ambitious project which is totally adapted to the well-known expertise of its members. They will continue to work on complex matter, at the heart of their activity, but also propose to work on interdisciplinary projects in connection with medicine, collective behaviours and biology. These are undoubtedly projects that will enable them to continue their excellent scientific activity.

## RECOMMENDATIONS TO THE TEAM

The committee recommends that the team's researchers continue their excellent research and maintain both the cohesion of the team and their numerous collaborations, notably with experimentalist groups.



# CONDUCT OF THE INTERVIEWS

## Dates

**Start:** 26 November 2024 at 8:30 a.m.

**End:** 27 November 2024 at 17 h 30

Interview conducted: online

## INTERVIEW SCHEDULE

#### TUESDAY 26 NOVEMBER 2024.

08.45 - 09.00 Presentation of the committee and the programme 09.00 - 10.00 Director's presentation to the committee, sponsors and staff 10:00 - 10:30 Questions from the committee and discussion 10:30-11:00 Closed session and break 11h00 - 12h40 2 Scientific presentations (2\*(35'+15')) Team 'Quantum systems' by Maurizio Fagotti Team 'Statistical physics, field theory and integrable systems' by Satya Majumdar Closed session Lunch break Lunch break 14h30 - 15h20 1 Scientific presentation (1\*(35'+15')) Team 'Disordered systems, soft matter and physics at interfaces' by Valentina Ros Committee closed session or break 15:30 - 16:00 Exchange between the committee and PAR (ITA/BIATSS/CDD/CDI) 16:00 - 16:45 Committee discussion with PhD students and Postdocs

#### WENESDAY 27 NOVEMBER 2024.

08:45 - 9:30 Committee - C/EC exchange Committee closed and break 9:45 - 10:30 Committee/trustees exchange Committee closed session (to prepare for meeting with management) 11:00 - 11:30 Committee exchange with previous management 11:30 - 12:30 Committee meeting with management (& future management) Lunch break Lunch break 14:00 - 15:30 Committee closed session (discussion of report)



# GENERAL OBSERVATIONS OF THE SUPERVISORS

The institution responsible for submitting the application, which is also responsible for coordinating the response on behalf of all the research unit's supervisors, did not submit any general observations.

Evaluation of the academic formations Evaluation of the national research organisms Evaluation and International accreditation



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