Research evaluation

REPORT ON THE RESEARCH UNIT:
Laboratory for Radiation and Matter Studies in Astrophysics and Atmospheres (LERMA)

UNDER THE SUPERVISION OF THE FOLLOWING INSTITUTIONS AND RESEARCH BODIES:
L'Observatoire de Paris
Université Pierre et Marie Curie
École Normale Supérieure – ENS
Université de Cergy-Pontoise - UCP
Centre National de la Recherche Scientifique - CNRS

EVALUATION CAMPAIGN 2017-2018
GROUP D

In the name of Hcéres[1]:

Michel Cosnard, President

In the name of the expert committee[2]:

Olivier Le Fèvre, Chairman of the committee

Under the decree No.2014-1365 dated 14 november 2014,

[1] The president of Hcéres "countersigns the evaluation reports set up by the expert committees and signed by their chairman." (Article 8, paragraph 5);

[2] The evaluation reports "are signed by the chairman of the expert committee". (Article 11, paragraph 2).

This report is the sole result of the unit's evaluation by the expert committee, the composition of which is specified below. The assessments contained herein are the expression of an independent and collegial reviewing by the committee.

UNIT PRESENTATION

Unit name:	Laboratory for Radiation and Matter Studies in Astrophysics and Atmospheres
Unit acronym:	LERMA
Requested label:	UMR
Application type:	Renewal
Current number:	8112
Head of the unit (2017-2018):	Mr Dariusz C. LIS
Project leader (2019-2023):	Mr Dariusz C. LIS

Number of teams or themes: 4

COMMITTEE MEMBERS

Chair: Mr Olivier LE FEVRE, Aix-Marseille université

Experts:

Ms Aurore BACMANN, université de Grenoble (for representative of the National Committee for Scientific Research, CoNRS)

Ms Chantal CLAUD, CNRS

Mr Gilles KACZMAREK, CNRS (supporting personnel)

Mr Stephan SCHLEMMER, Köln university, Allemagne

Mr Karl SCHUSTER, Institut de Radio Astronomie Millimétrique

Ms Annie ZAVAGNO, Aix-Marseille université (for representative of the Board of French Universities, CNU)

HCERES scientific officer:

Mr Michel MARCELIN

Representatives of supervising institutions and bodies:

Mr Claude CATALA, L'Observatoire de Paris

Mr Yves LASZLO, École normale supérieure

Mr Guy PERRIN, CNRS-INSU

Mr Stéphane REGNIER, université Pierre et Marie Curie

Mr Pascal VINCENT, université Pierre et Marie Curie

Mr Dan VODISLAV, université de Cergy-Pontoise

INTRODUCTION

HISTORY AND GEOGRAPHICAL LOCATION OF THE UNIT

LERMA is a department of L'Observatoire de Paris. It is located at 5 separate locations, two at L'Observatoire de Paris premises, one at UMPC, one at university Cergy-Pontoise, and one at ENS (Ulm). The Laboratoire de Physique Moléculaire pour l'Atmosphère et l'Astrophysique merged with LERMA in 2014.

MANAGEMENT TEAM

LERMA director Mr Dariusz LIS has set a management team with Mr Jean-Hugues FILLION and Mr Franck LE PETIT as deputy directors, Mr Jean-Michel KRIEG as technical director, Mrs Valérie AUDON for HR aspects and Mr Laurent GIROT (replaced by Mrs Murielle CHEVRIER in October of 2017) for financial aspects.

HCERES NOMENCLATURE

ST3: Earth and Space Science.

SCIENTIFIC DOMAIN

LERMA addresses topics in key areas of astrophysics, physics, and earth science. There are three main areas of activity: studying cosmology and the formation and evolution of galaxies, interstellar medium and plasma physics, and molecules in different environments in the universe. In addition, LERMA conducts technical developments of instrumentation, including remote sensing.

UNIT WORKFORCE

Unit workforce	Number 30/06/2017	Number 01/01/2019
Permanent staff		
Full professors and similar positions	10	12
Assistant professors and similar positions	24	24
Full time research directors (Directeurs de recherche) and similar positions	9	13
Full time research associates (Chargés de recherche) and similar positions	5	5
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")	0	0
High school teachers	1	0
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	34	35
TOTAL permanent staff	**83**	**89**
Non-permanent staff		
Non-permanent professors and associate professors, including emeritus	7	

Non-permanent full time scientists, including emeritus, post-docs	7	
Non-permanent supporting personnel	12	
PhD Students	40	
TOTAL non-permanent staff	**66**	
TOTAL unit	**149**	

GLOBAL ASSESSMENT OF THE UNIT

The LERMA is conducting front-end research in four areas, covering galaxies and cosmology, interstellar medium and plasma, molecules in the universe, heterodyne instrumentation and the development of innovative methodologies to retrieve key astrophysics and Earth variables from satellite and ground-based observations.

The scientific production of the past period is of very high quality, with an impressive list of papers in refereed journals. A number of key results have high scientific standing in the international community.

The research staff has been maintained approximately constant over the period, with new people joining and compensating retiring personnel. There is a concern expressed for the future as the wave of retirements will continue, and ways to recruit new staff will have to be found to maintain LERMA standing.

The LERMA is strongly involved in teaching activities, including a high rate of PhD defended during the period.

The LERMA is spread over several disjoint sites, which is a clear difficulty to maintain a cohesive set of activities. However, the LERMA seems to cope quite well with this difficulty. Following the recommendations of the previous visiting committee, the previous management team prepared a restructuration resting on scientific poles rather than per site, following extensive consultations with the staff ahead of the merger with LPMAA (Laboratoire de Physique Moléculaire pour l'Atmosphère et l'Astrophysique). This new structure has been fully implemented by the current management team and is perceived as very positive.

DETAILED ASSESSMENT OF THE UNIT

CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES

A – Scientific outputs and activities, academic reputation and appeal

Strengths

The publication record of LERMA is excellent, with more than three papers in refereed journals per year per permanent researcher over the period. LERMA team members are involved in a number of large international collaborations, providing opportunities for front end science with high visibility. In particular the involvement of LERMA in the scientific exploitation of the Herschel space mission is remarkable.

LERMA scientists are strongly involved in organizing or participating to international conferences and workshops, with invited contributions. They participate in national and international committees, providing an important contribution to the science support to a broad community. Several scientists have been awarded prestigious prices at the national and international levels.

CNAP ANO (Action Nationale d'Observation) is organized around the expertise of the unit, delivering a visible service to the community.

Weaknesses

The list of projects tackled by LERMA is large, and there is a risk that some of them are under-staffed.

The level of participation from post-doctoral researchers is found to be relatively low in comparison to other leading institutes in France.

Assessment of scientific outputs, reputation and appeal

LERMA is an excellence institute with a high science production rate, international recognition, placing it at a level equivalent to the best institutes in France and Europe.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

Strengths

LERMA is strongly involved in sciences education for young public and in the training of teachers. The institute shows a strong interest for interdisciplinary outreach (Art & Sciences) creating connection with the civil society.

The active participation to public outreach linked to instrumentation development increases the impact of outreach (concrete actions).

Weaknesses

The public outreach activities are not coordinated at the institute level. News and press releases are not visible in LERMA's website; rather, they appear at the Paris Observatory level.

Assessment of the interactions with the non-academic world

Interactions with the non-academic world are at a good level, as the result from the initiative of several individuals.

C – Involvement in training through research

Strengths

LERMA benefits from a rich academic environment (UMPC, ENS, UCP, UPD) and actively invests in training through research.

LERMA contributes to high-level management responsibilities in doctoral schools. Education represents an important part of LERMA's diffusion of knowledge.

LERMA innovates to increase the attractiveness of education and teaching at all levels, with concrete propositions for the near future with the participation in MOOC-related teaching.

There is a noteworthy involvement in teaching actions with Vietnam (Hanoï).

There is a high number of permanent staff holding the HDR - a positive indicator.

Weaknesses

The coordination, at the laboratory level, of all the actions linked to training through research, education and outreach, is not clearly identified. Having a coordinator at LERMA to follow and structure these activities would help to gain in effectiveness and possibly develop even more this field.

The students were not aware that all of them were invited to meet with the committee. A limited number of students was present, without any representative mandate.

Assessment of the involvement in training through research

LERMA staff supervises a large number of PhD students, and actively participates in the management of doctoral schools.

CRITERION 2: UNIT ORGANISATION AND LIFE

Strengths

LERMA is organised around 4 poles paving the range of activities. Some of the poles are large entities including several different groups, allowing improved coordination.

LERMA is functioning very well, and the restructuring engaged with the current management team, with a management resting on poles rather than per site, is perceived as positive. The director and director's team are commended for their successful efforts following the recommendations of the previous visiting committee.

The gender diversity balance is better overall at LERMA than for a typical physical/technical science area.

Weaknesses

The goal "from interaction towards common strategy" set by the management remains a major challenge for LERMA. One yearly general assembly seems to be a potentially insufficient effort to overcome the challenges posed by the large scientific diversity and spatial separation on different sites.

The management by scientific poles remains to be fully integrated with the reality of LERMA being spread on five different sites. It appears that ensuring the necessary level of administrative support (financial, human resources) is still difficult. This creates some frustration among staff members.

Engineering staff (ITAs) is assigned to the scientific poles and there is no apparent technical organization around key engineering expertise (métiers). One consequence of this organization is that the technical staff may need to move from one site to another, with a loss of efficiency.

Some staff members, including in the management team, seem to be exposed to a considerable workload, beyond what is normally expected from their duties. This may be acceptable for a short period, but only if this situation should not become standard.

Assessment of the unit's life and organization

The different poles in LERMA seem to function very well, judging from their scientific output. However, the frequency of general team meetings, at the poles level, and at the LERMA level, could be improved. There is a general concern about LERMA being spread over 5 different sites, resulting in a sub-optimal level of administration support and in office space limitations (site dependent). Some staff members may be subject to work overload.

CRITERION 3: SCIENTIFIC STRATEGY AND PROJECTS

The scientific project is well integrated in the future landscape of universe sciences, with involvement both at the national and at the international level in the key scientific priorities of the coming decade (e.g. the origin of the universe, of galaxies, of planets, of life). Their contributions address both the universe at large and earth observations.

The scientific strategy proposed by LERMA in the coming years builds on the strengths of the institute and will help to maintain its position in the areas where it is currently in a leading position. LERMA is present in a wide range of activities, from development of instrumentation to laboratory experiments, theory, numerical simulations and observations.

The institute is taking part in the large space missions important to the discipline, with either scientific contributions or instrumental contribution. The excellence of their instrumental achievements has placed LERMA at the forefront for large future space missions like JUICE, and they are well placed for the development of an instrument on-board the OST (Origin Space Telescope). They are also getting involved in new international collaborations (e.g. with Russia and China) with an important potential scientific return (access to large observing facilities).

LERMA scientists will continue to be involved in the use of existing facilities, and are active in the scientific preparation of new experiments, at the forefront of the discipline (e.g. JWST, SKA, Euclid or SWOT). Numerical simulations and code development for the community are another core strength of LERMA, which they are planning to extend in the coming five years, with a link to community services (ANO). The projects for laboratory activities using state of the art facilities (both internal and external) and theoretical calculations applied to molecular reactions or excitation are also important drivers for the understanding of the interstellar medium.

The means to achieve their goals are adequate as far as funding goes (current involvement in LabEx, ANR, ERC). The activities could however suffer from an important number of retirements in the near future if the positions are not replaced. Strategic planning will help to cope with these issues.

Strengths

The project is clearly ambitious. It encompasses many aspects (theory, laboratory experiments, observations, numerical developments and instrumentation), and should further strengthen the leading role of LERMA in those fields.

The activities planned for the next period are well integrated in the future large international projects and tackle the key questions of the discipline. LERMA scientists are very active in the development of these projects.

The institute has numerous international collaborations.

The development of Big Data and machine learning activities is particularly interesting in the context of very large data sets.

Weaknesses

There is a risk of being over-ambitious. LERMA is planning to be involved on a long list of projects. It is not clear whether the human resources necessary to be involved in each of them at the right level to be a leader or a high-level partner will be available.

It is not clear how some activities which are threatened by future retirements will continue if key positions are not renewed.

Jumping from one space project to another is particularly difficult for the astronomy THz subunit, and a participation in a ground or air based sub-mm project would be highly beneficial to overcome this problem.

Assessment of the scientific strategy and projects

The strategy of LERMA focuses on the strengths developed over the past years. It is ambitious and well integrated in the international scene. The ambition rests on maintaining the staff complement at the current level, replacing retiring personnel.

RECOMMENDATIONS TO THE UNIT

A – Recommendations on scientific production and activities (criterion 1)

A.1 The quality and quantity of the scientific production is exceptional.

A.2 Having a coordinator at LERMA to follow and structure the training through research activities would help to gain in effectiveness and perhaps develop even more this field.

A.3 A coordination of outreach activities at the level of LERMA is advisable, with the goal to better promote the output from LERMA.

A.4 The work force from post-doctoral researchers is essential to a leading institute like LERMA. The committee recommends developing a plan to seek for all opportunities available in France and Europe (ANR, ERC, Marie-Curie fellowships, CNES…) and that LERMA actively supports proponents in making funding proposals.

A.5 The committee recommends setting-up a working group dedicated to the follow-up of PhD students, including statistics about their future careers.

B – Recommendations on the unit's organization and life (criterion 2)

B.1 The committee recommends increasing the level of interaction between all actors on an institute-wide scale, supporting the goal to define and maintain a common strategy.

B.2 The current management has improved the overall feeling of the staff belonging to one single institute despite being spread over five different sites on a wide range of activities. However, there is a general concern that the organization of LERMA is sub-optimal, with difficulties related to administration support, human resources management, and office space. The committee recommends that LERMA implements an internal quality program, performing a review of its key processes, including budget allocation and financial reporting, with the aim to rationalize and produce clear and simplified procedures made known to the whole staff.

B.3 Priorities in recruiting technical and scientific staff shall benefit from being regularly reviewed and followed-up with motivated recruiting requests towards the tutelles.

B.4 The management of the technical staff would benefit from a functional organization chart (organigramme) identifying the job assignment of each of the technical staff.

B.5. To avoid work overload, a regular review of individual activities is necessary, making sure that the work commitment corresponds to the available work force. Temporary overload may be acceptable, but if this would happen on the long term, this requires making choices on which projects are to be supported.

B.6 The committee has been made aware of the evolution of the ENS Physics department, possibly affecting LERMA organization. The staff is aware of this, and this is a source of worry for the future. The committee recommends that LERMA conducts a dedicated prospective study with the concerned LERMA team with the goal to establish what would be the best for LERMA to maintain its excellence in science.

B.7 The committee recommends placing all installations, including those using dangerous laser sources, under the appropriate security norms. Personnel must continue to be regularly trained on security issues.

B.8 (written in french to link with french terminology): le correspondant formation, l'agent de prévention, les secouristes du travail et le référent sécurité laser doivent bénéficier de formations régulières et être clairement identifiés sur l'organigramme fonctionnel du laboratoire.

C – Recommendations on scientific strategy and projects (criterion 3)

C.1 Given the large list of projects listed in each of the poles, and uncertainties on the evolution of the work force, the committee recommends to develop and maintain a running list of science programs and technical projects, with levels of priority. Estimating the level of involvement from LERMA, financial and in personnel for each of these projects, will support the teams to be reactive in engaging into projects in the priority list.

C.2 To support the continued participation to national and international research and instrumentation programs, the committee recommends setting-up a staffing plan build taking into account the scientific and

engineering profiles necessary for each project, versus the expected evolution of the work force (e.g. retirements). This plan should form the basis to motivate new positions from the tutelles, and to efficiently support the candidates for recruitment or promotion.

TEAM-BY-TEAM ANALYSIS

Team 1: Galaxies and cosmology

Team leader: Ms Françoise COMBES

TEAM WORKFORCE

Team workforce	Number 30/06/2017	Number 01/01/2019
Permanent staff		
Full professors and similar positions	3	4
Assistant professors and similar positions	3,5	3,5
Full time research directors (Directeurs de recherche) and similar positions	1	2
Full time research associates (Chargés de recherché) and similar positions	0,5	0,5
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")	0	0
High school teachers	0	0
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	1	2
TOTAL permanent staff	**9**	**12**
Non-permanent staff		
Non-permanent professors and associate professors, including emeritus	0	
Non-permanent full time scientists, including emeritus, post-docs	2,5	
Non-permanent supporting personnel	1	
PhD Students	12	
TOTAL non-permanent staff	**15,5**	
TOTAL team	**24,5**	

CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES

A – Scientific outputs and activities, academic reputation and appeal

Strengths

The team is tackling important topics in cosmology and galaxy evolution, including physical and baryonic processes, and has acquired international recognition on many fronts.

The common thread is the detailed confrontation of theory, observations, and simulations. The team maintains a remarkable balance between large surveys for statistical analysis and detailed observations for in-depth physical analysis.

The publication record in the past 5 years period is outstanding, with many papers over the 100 citations count.

The participation to international programs like Planck, PHIBSS, Euclid, and others, and the use of large facilities like NOEMA, ALMA, VLT, ensures access to front end science.

The team has recently accreted two external scientists from L'Observatoire de Paris, expanding the team expertise towards science with clusters of galaxies and galaxy structural properties with Big Data perspectives.

Many scientists are well-known internationally. Members of the team are members of international committees, including telescope time allocation committees.

Weaknesses

Even though the team has attracted new people, the permanent staff remains spread thin between many exciting programs.

The number of post-docs is on the low side after the end of the ERC Momentum.

Priorities may need to be implemented in the future to adjust to the available workforce.

Assessment of scientific outputs, reputation and appeal

Outstanding track record in leading original programs at the interface between theory, observations and simulations. High number of publications and citation record.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

Strengths

Several scientists are strongly involved in public outreach.

Weaknesses

A team-wide coordination to identify and produce public press-releases is missing.

Assessment of the interactions with the non-academic world

The team rests on the personal involvement of a few team members, with a visible output. A team coordination around outreach activities would further improve on this already good record.

C – Involvement in training through research

Strengths

The high rate of HDR offers a lot of potential for training through research.

The current count of PhD students is higher than average.

Weaknesses

The number of thesis defended in the past 5 years seems to be on the low side (~1 per year) as reported on the above table. This should invert given the current number of PhD students. This is probably only due to low number statistics.

Assessment of the involvement in training through research

The team is efficient in training PhD students, with some fluctuation over the years.

CRITERION 2: TEAM ORGANISATION AND LIFE

Strengths

The team has developed an exceptional ability to be present on many leading projects at any given time.

The leadership of a few senior scientists is essential to the team.

The team is successful in obtaining observing time at major facilities.

The opportunistic strategy of participation to large international programs pays off in science return.

There is a very good gender balance with the ratio of women to men

Weaknesses

There is apparently no clear weekly agenda driving the day-to-day life of the team.

The opportunistic strategy described above may weaken the longer-term strategy of the team.

There is a worry that the participation to a large number of projects may weaken the visibility of the team.

The definition of priorities may be necessary to ensure that an adequate number of scientists follows each project.

The exceptional production rate rests on the leadership of a few individuals.

Assessment of the team's life and organization

The team has an apparent lack of formal organization.

CRITERION 3: SCIENTIFIC STRATEGY AND PROJECTS

Strengths

The team focuses on key science questions following international prospective plans. This includes CMB (Planck exploitation), galaxy clusters and their evolution, the physics of galaxies at low and high redshifts, the epoch of reionisation.

The use of large facilities to produce relevant data is well identified, including ALMA, Euclid, JWST, SKA.

Weaknesses

The range of science investigations is large for the team as it is. Priorities may need to be established.

Methods to constrain the detailed physics investigated from simulations with observations coming from next generation facilities are not made explicit enough to guarantee that the core expertise of the team will be maintained.

Assessment of the scientific strategy and projects

The project is ambitious in covering a large range of important science questions, in line with the team's expertise. Maintaining focus with the available staff may require setting priorities.

RECOMMENDATIONS TO THE TEAM

A – Recommendations on scientific production and activities (criterion 1)

The committee recommends continuing such a high publication rate at the best international level, with a wide range of science projects.

B – Recommendations on the team's organization and life (criterion 2)

While the team demonstrates an exceptional production rate, this rests on the leadership of a few individuals. The committee recommends identifying and supporting the emergence of young leaders.

C – Recommendations on scientific strategy and projects (criterion 3)

The scientific projects are ambitious, and the team has demonstrated its ability to carry out several projects simultaneously. However, the committee feels that the team would benefit from maintaining a priority list to ensure that the most important projects receive the level of support necessary for a high visibility and science return.

Team 2: Interstellar medium and plasma

Team leader: Mr Thibaut LE BERTRE

TEAM SCIENTIFIC DOMAIN

The team is specialised in studies of the interstellar medium, star and planet formation and stellar plasmas.

TEAM WORKFORCE

Team workforce	Number 30/06/2017	Number 01/01/2019
Permanent staff		
Full professors and similar positions	2,5	4
Assistant professors and similar positions	4,5	3,5
Full time research directors (Directeurs de recherche) and similar positions	5,5	1,5
Full time research associates (Chargés de recherché) and similar positions	3	0,5
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")	0	0
High school teachers	0	0
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	3,5	2
TOTAL permanent staff	**19**	**11,5**
Non-permanent staff		
Non-permanent professors and associate professors, including emeritus	3	
Non-permanent full time scientists, including emeritus, post-docs	4	
Non-permanent supporting personnel	2	
PhD Students	12,5	
TOTAL non-permanent staff	**21,5**	
TOTAL team	**40,5**	

CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES

A – Scientific outputs and activities, academic reputation and appeal

Strengths

This is an outstanding research group with many renowned experts in the field, combining expertise in observations and modelling. There are clear synergies between the 4 sub-teams.

The team has an outstanding scientific output (even counting out the Planck collaboration publications) and publishes in the high impact factor journals of the discipline. Its members are widely present in scientific/telescope committees. They are successful users of state-of-the-art observing facilities and have conducted large observing programs (Herschel, IRAM 30m) involving large international teams. Important results in the past five years include (but are not limited to) understanding the endothermic formation of chemical species in the diffuse ISM based on Herschel observations (key program led by a researcher of the team), the discovery of protostellar candidates in their first stages of evolution, designed new methods to account for H2 formation on grains, and further developed the PDR code, offered to the community, in order to interpret data from new instruments.

Many scientists from the team are well recognized internationally, and this includes some of the younger researchers as well. They are also successful with applications for funding (2 ANR as PI, 3 as co-I, 1 ERC senior, 1 LabEx) and are regular recipients of funding from "Programmes Nationaux". The team is highly attractive for foreign visitors and postdocs and has many international collaborations.

The team is very diverse in its activities but the research they carry-out is coherent between the 4 sub-poles of the team (addressing questions ranging from the ISM, star and planet formation, circumstellar matter and plasma physics), with interesting synergies between some of the sub-poles.

Weaknesses

The team is composed of 4 sub-poles dispersed at 3 different locations. The plasma pole seems not as well integrated to the lab as it could be, or the synergies are not sufficiently highlighted. The team suffers from an unfavourable age pyramid. This will weaken the team activities in the near future with the retirement of many renowned experts in the field who actively participate in the international recognition and successes of the team. Machine Learning is mentioned as a promising tool for the future but its real prospect is not yet properly assessed because of a lack of dedicated manpower.

Such a strong team should aim to take more science leadership or co-leadership in visible international programs.

Assessment of scientific outputs, reputation and appeal

The team has an outstanding scientific output and international reputation but its continued impact risks to be weakened in the near future by an unfavourable age pyramid.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

Various team members participate in public outreach events (public talks, festivals, visits of the observatory) and present their results in the media. They are involved in innovative technics for education, at all levels, including e-learning.

Strengths

People from the team actively participate to education and outreach.

Some of them are involved in high-level management of doctoral schools.

Weaknesses

Poor information was given in the report and in the presentation to the committee, at the team level, about the quantitative implication of the team members in outreach activities and interaction with the non-academic world.

Assessment of the interactions with the non-academic world

Team members are involved at various levels in outreach activities. Coordination of the various activities is encouraged to increase the visibility of these activities.

C – Involvement in training through research

The team has trained a large number of students and interns.

Many of the team researchers have the HDR.

Strengths

The team is very active in training students at master and PhD levels.

Many PhDs have led to reference publications in scientific journals.

Weaknesses

Apart from the number of PhD students, no quantitative information is given about their integration in the team, the number of publications or their future. It would have been interesting to learn more about the PhDs' distribution among the different sub-poles. This lack of information renders the assessment difficult beyond the general fact that the team trains students in an active way. No clear information was given to PhD students about the Hcéres visit at the LERMA and team's level, resulting in only a small part of them being present at the meeting with the Hcéres committee.

Assessment of the involvement in training through research

The team has a clear and strong involvement in training through research. However, the lack of details about PhD students (repartition and integration in the sub-poles, the impact of PhDs through publications, follow-up of students during the PhD…) makes the assessment of this criterion difficult. It would be beneficial for LERMA to setup a working group dedicated to the follow-up of PhD students, including statistics about their future careers.

CRITERION 2: TEAM ORGANISATION AND LIFE

The team is large (46 people) and geographically split between several geographical locations. Efforts have been made to promote interactions between the different sites (e.g. joint meetings taking place alternatively at OM, OP, UPMC or ENS). It is not clear how effective this is in bringing team members together.

The proportion of women in the team is close to 40% at all levels (staff and PhD), which is higher than the national average in astrophysics (which is already higher than the average at the international level).

Strengths

The team works well and a concrete effort has been made (and is continued) to build a coherent group with strong scientific synergies which are one of the success-keys of this team. Combining simulations, observations and laboratory experiments produces a broad and deep expertise in this research field. An annual meeting is organized by the team leader to present and discuss the scientific activities in order to keep and reinforce the scientific coherence of the sub-poles.

Weaknesses

The team is large and split on different geographical locations, so that maintaining the coherence between the sub-poles is challenging. The links between the plasma pole and the other sub-poles appear weaker than for the other poles.

More regular meetings (beyond a large annual one) centered on selected research activities that are well adapted to full synergy developments between the 4 sub-poles might help in maintaining synergies between the poles, optimizing coordination efforts.

Assessment of the team's life and organization

Real efforts are made in the team to create and maintain a strong synergy between the 4 sub-poles. However the large number of people in the team and several sub-poles split on different sites makes it difficult to maintain a cohesive set of actions.

CRITERION 3: SCIENTIFIC STRATEGY AND PROJECTS

The research project is ambitious while remaining entirely feasible for a team with such a track record. It is based on newest observing facilities (e.g. JWST, ALMA, NIKA2/IRAM, SOFIA, SPHERE/VLT) and numerical developments (CHEMSES, PDR code, stochastic models), as well as funding opportunities (ERC, ANR). It involves many international collaborations (e.g. Taïwan, Chile, Italy) and tackles important and timely questions for the understanding of the ISM and star formation processes.

The development of machine learning techniques adapted to big data experiments is well identified. Developing such techniques is a particularly interesting and novel approach to tackle the ever increasing volume of data.

Strengths

The team presents a very strong and rich scientific project reinforced by already obtained funding (ERC, ANR). The capacities of the team to lead such an ambitious project are demonstrated.

Weaknesses

Importance is given in the project to Machine Learning Techniques. However, it appeared to the committee that, due to a lack of work force, this promising method has not yet been properly assessed, rendering this part of the project more fragile.

Plasma activities appear less well integrated in the team, synergies are mentioned with other teams at LERMA without being detailed.

SKA was mentioned in the introduction but does not appear in the research projects.

Among the threats mentioned by the team is the lack of career perspectives for assistant professors and an important number of retirements within the next 10 years. For the latter point, it is not clear what the strategy is if the positions are not replaced. The lack of IT positions is also a problem.

Assessment of the scientific strategy and projects

The scientific project is strong and reinforced by the level of funding already obtained. The Machine Learning part is appealing and deserves further investigation with dedicated work force to fully assess its potential.

RECOMMENDATIONS TO THE TEAM

A – Recommendations on scientific production and activities (criterion 1)

The scientific production and activities are outstanding. Increasing the scientific synergies between the 4 sub-poles will increase even more the scientific impact of the team as a whole (see criterion 2).

B – Recommendations on the team's organization and life (criterion 2)

The team suffers from an unfavourable age pyramid. This is a risk that may affect the activities and a strategy should be developed by the pole to counter the impact of this fact.

The team is large in number of people with 4 sub-poles and split at different geographical locations. This makes the organization to maintain the global scientific coherence difficult. More frequent meetings around a subset of activities, supporting a strong scientific strategy, would help to maintain the global coherence, including the part dedicated to plasma experiments.

A dedicated and quantitative analysis of PhD students' impact (distribution in the sub-poles, publications, future…) would reinforce the strength of the team.

C – Recommendations on scientific strategy and projects (criterion 3)

The unfavourable age pyramid of this outstanding team presents a real threat for the near future. The committee recommends developing as soon as possible a strategy addressing this threat. While there is no immediate and single solution, a combination of actions involving the training of young researchers in capacity to obtain a permanent position, reinforcing the presence of postdoctoral fellows, or attracting researchers for relocation at LERMA, might be considered. At the same time, mitigating this risk will require to develop a strategy with priorities in the science activities, to be prepared to focus on a smaller number of projects if the staff is reduced. It is recommended to focus the strategy on a lower number of projects, favouring the inter-pole synergy. General sub-poles meetings on a regular basis are advisable, in addition to the annual meeting of the whole team.

This team has capitalized on major results from infrared missions in space (Herschel, Planck) strongly linked to the historic instrumental experience of LERMA in submillimetre astronomy. No future space mission in this domain has been decided yet (under discussion for Origins Space Telescope). The strategy of the team in this area should also be analysed, with ways to mitigate the risk that a decision on a space mission with involvement of the team might be postponed for many years. Ways to diversify the sources of data should be further explored.

The committee recommends seeking more leadership or co-leadership of large international program.

Team 3: Molecules in the universe

Team leader: Mr Christof JANSSEN

TEAM SCIENTIFIC DOMAIN

The team focusses on experimental and theoretical techniques with a view to studying molecular processes relevant to astrophysical objects, planetary and Earth's atmospheres.

TEAM WORKFORCE

Team workforce	Number 30/06/2017	Number 01/01/2019
Permanent staff		
Full professors and similar positions	4	4
Assistant professors and similar positions	14	14
Full time research directors (Directeurs de recherche) and similar positions	0	0
Full time research associates (Chargés de recherché) and similar positions	1	1
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")	0	0
High school teachers	0	0
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	7,5	10,5
TOTAL permanent staff	**26,5**	**29,5**
Non-permanent staff		
Non-permanent professors and associate professors, including emeritus	3	
Non-permanent full time scientists, including emeritus, post-docs	0	
Non-permanent supporting personnel	0,5	
PhD Students	6,5	
TOTAL non-permanent staff	**10**	
TOTAL team	**36,5**	

CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES

A – Scientific outputs and activities, academic reputation and appeal

Strengths

The laboratory experiments on the heterogeneous chemistry (production of O2 through dismutation of H2O2 during water ice desorption) diffusion and desorption (direct measurement of desorption and diffusion energies of O and N atoms physisorbed on amorphous surfaces) are highly competitive on an international level.

Similarly, the wavelength-resolved photodesorption and photochemistry of CO2 ices drew the attention to important details of the photodesorption process.

Quantum chemical calculations of inelastic (Ro-vibrational excitation of SiO by collision with helium) and reactive (Time-Dependent Quantum Wave Packet Study of the Si + OH → SiO + H Reaction, Theoretical study of HCN-water interaction) collisions are very important for the interpretation of astrophysical observations.

Making molecular data available to astrophysicists in data bases (A Collisional Database Repository and Web Service within VAMDC) is also an important task, where the LERMA team has a leading role.

For the Molecules and Plasma in Space activities, there is an excellent output, with a team being very dynamic.

Weaknesses

The connection of plasma experiments to theory and observations is somewhat unclear.

Some of the activities seem to be detached from the astrophysical context. The precision of the frequency comb based spectrometer is probably very impressive. How the "ultra-precise" spectroscopic data shall be used to utilize isotopes as new tools is not obvious.

Similarly, the greenhouse gas monitoring is certainly interesting and important but how results from this work have an impact on the astrophysical context of the LERMA teams is not fully apparent. Nevertheless also method developments like in the work "On the gas dependence of thermal transpiration" is important and it may be due to the limited space in the report that such aspects do not receive full attention.

Assessment of scientific outputs, reputation and appeal

The team is composed of rather diverse sub-groups. Their research activities meet the international standard. Many of the on-going work and results are very well known and respected by the community. In part some results (as the examples listed above) set the state-of-the-art in laboratory astrophysics.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

Strengths

From the list of the socio-economic indices, it seems that the team is mainly focused on the research they are doing.

The Cergy team presented an interesting movie which shows how the experiments work and how the group is working together. This certainly took a lot of effort but it might be a good way to attract students and/or to interest other groups.

Weaknesses

From the list of the socio-economic indices it appears that the team is not much concerned with interactions with the non-academic world, impacts of their work on economy, society, culture or health.

Assessment of the interactions with the non-academic world

Today it is common to teach the society, also as a recruitment activity, and pupils at a non-expert level. For those reasons, it might be in the team's own interest to increase those activities. Research interests like the greenhouse monitoring usually draws public attention and is a first step for the public to get interested in fundamental sciences.

C – Involvement in training through research

Strengths

12 habilitations is a high number for this size of a group.

Weaknesses

Apart from the high level of teaching duties mentioned in the report, the number of educational outputs is limited.

Assessment of the involvement in training through research

Based on the limited numbers given in the table it is difficult to evaluate the assessment in training through research. The number of completed PhD thesis is probably below international standards given the sizable number of instructors.

CRITERION 2: TEAM ORGANISATION AND LIFE

Strengths

The organization of the sub-teams at each location is well set.

Weaknesses

The range of science projects is very large and the team does not appear to share a common strategy. The team appears as a grouping of several independent sub-groups.

Assessment of the team's life and organization

The pole is well organized around well identified projects. The range of science projects is very large, and teams are spread on several different sites. This makes a coherent strategy common to the whole pole difficult to establish and follow. The number of female scientists in this team is above the international standard and should be further fostered.

CRITERION 3: SCIENTIFIC STRATEGY AND PROJECTS

Strengths

Most scientific themes are well established yet they are rather timely and the pick of topics is giving the team a visible profile on an international level. Following the activities of several sub-groups over a long time,

there are strong new aspects which pick on new understanding of the microphysics of the molecules as well as on future observational options such as JWST.

Weaknesses

Some activities are not as well connected to the astrophysical context of LERMA. This is likely due to the team being located in 3 different places, which makes interactions more difficult as already pointed out in the report.

Assessment of the scientific strategy and projects

Activities focusing on common scientific topics like the isotopes and spin isomers are emerging. This is a positive development which might give the team more visibility.

RECOMMENDATIONS TO THE TEAM

A – Recommendations on scientific production and activities (criterion 1)

The groups shall continue at the same excellent level as they did in the past. Continued high-level scientific output will keep the visibility of the groups and team. Community efforts like the VAMDC database which is of benefit for many teams demonstrate the role LERMA takes on an international level. Efforts should be taken to strengthen these activities.

B – Recommendations on the team's organization and life (criterion 2)

The team should keep on with the common seminars, also exploring new communication technologies for scientific exchanges across the team.

Overall it might be good to place some incentives (additional funding?) from the LERMA lead and other resources to encourage more interactions between the groups. However, the common efforts for team building are already quite impressive, given that each group is guided not only by the overarching LERMA institute, but by each local organisational structure (different universities, etc.).

More efforts could be dedicated to outreach activities, increasing visibility to attract more students.

C – Recommendations on scientific strategy and projects (criterion 3)

Focusing on common subjects like the isotopes appears as a good move to motivate for more synergy among the groups, being located at quite some distance. Strengthening the interaction between the experimental laboratory groups and the groups working on basic theory might lead to stronger motivations of the young scientists on either side.

Integration of the groups with somewhat outside topics by identifying more common themes might create an even better visibility of the LERMA laboratory activities. The topic on isotopes is already one visible example.

The committee recommends increasing the relation between experiments and the broader astrophysical context of interest to LERMA.

Team 4: Instrumentation and remote sensing

Team leader: Ms Catherine PRIGENT

TEAM SCIENTIFIC DOMAIN

The pole consists in an Instrumentation Group specialized in THz devices and Earth and Planet Remote Sensing activity, developing innovative methodology for the estimation of surface and atmosphere variables from space.

TEAM WORKFORCE

Team workforce	Number 30/06/2017	Number 01/01/2019
Permanent staff		
Full professors and similar positions	0,5	0,5
Assistant professors and similar positions	2	2
Full time research directors (Directeurs de recherche) and similar positions	2,5	2,5
Full time research associates (Chargés de recherché) and similar positions	0,5	0,5
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")	0	0
High school teachers	0	0
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	10	10
TOTAL permanent staff	**15,5**	**15,5**
Non-permanent staff		
Non-permanent professors and associate professors, including emeritus	1	
Non-permanent full time scientists, including emeritus, post-docs	0,5	
Non-permanent supporting personnel	4	
PhD Students	9	
TOTAL non-permanent staff	**14,5**	
TOTAL team	**30**	

CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES

A – Scientific outputs and activities, academic reputation and appeal

The team is split into two sub-groups with a common overall theme of THz detection but with different subjects and locations (Instrumentation Group and Earth Remote Sensing group). The power of the team could be enhanced by a closer interaction of the two sub-groups in terms of basic techniques and common projects.

The team has a large number of contracts; reflecting the very high level of expertise that has been acquired by these two groups, each in its domain. The group is well integrated into European networking activities through the HIFI-HERSCHEL and Radionet activities.

Keeping the workforce intact with adequate high level staff is more challenging than the specific scientific projects, which are numerous and for which the two groups are very well prepared. However space projects in the THz range seem too sparse to easily allow for continuity.

It should be noted that in another team ("Molecules in the Universe"), there is also expertise in high resolution molecular spectroscopy and ground based remote sensing.

Strengths

The team does important work with high international visibility in THz detection and remote earth observations. It has a renowned expertise in in Schottky THz devices and pursues developments of superconducting devices while the Remote Sensing group develops innovative algorithms for the estimation of atmospheric and surface variables from multiple-satellite observations, at global scale. This gives a combination of high technical and scientific expertise. Recent significant results illustrate this recognized expertise.

Both groups are internationally recognized.

The team has a large number of institutional contracts (space agencies, French ANR); the ratio in terms of supervised students is very good. These contracts are mainly institutional (space agencies, French ANR).

Each of these two groups has a very good level of publication. The team has produced about 90 publications, while the number of research scientists/professors is relatively reduced (4 researchers, 2 emeriti, 9 ITA, 7 PhD students, 3 CDD). This gives an excellent ratio. They attended a high number of conferences and are part of international working groups.

They have been involved for years in the preparation of future or planned satellite missions, and have developed a unique expertise in France.

Weaknesses

The pole consists in two different groups (Instrumentation Group and Earth and Planet Remote Sensing activity) with little contact between each other.

The number of permanent positions is limited, with specific needs linked to the departure of some staff.

As often with space missions, the group is involved in a variety of projects, and relies on temporary positions, which compensate only partially the decreasing number of permanent positions.

Assessment of scientific outputs, reputation and appeal

The team is a recognized place in France and in Europe for specific THz technology and earth remote sensing from space. The scientific output is on high level. With a unique expertise in instrumentation and remote sensing, and in spite of a relatively reduced staff, the pole has reached over the last years a very good level of publication, and international recognition.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

Socio-economic interaction with industry could likely be enhanced for a variety of treated topics if sufficient manpower is available. The created start-up is a good indicator that the general interest in the economic environment is considerable. Space related high precision work and programming is always a selling point for students and young people in general.

Strengths

General subjects treated can create high external interest. The pole has contracts with private companies. This reflects the very high level of expertise that has been acquired by these two groups, each in its domain.

A start-up (Estellus) has been created.

Weaknesses

The level of outreach activities could be improved, capitalizing on both science and technical expertise.

Assessment of the interactions with the non-academic world

With a large number of contracts and the creation of a start-up, this pole has significant interactions with the non-academic world. The committee recommends enhancing outreach actions.

C – Involvement in training through research

The number of professors in this team is critically small; however, this does not seem to affect the recruitment of PhD students (it might well be that PhD students come from engineering schools).

The group counts only 15 permanent members (including 2 emeriti), only 4 research scientists. This is perceived as a weakness. On top of this, there is now only one permanent position in terms of cleanroom engineers, instead of 4 previously.

Strengths

Group seems to maintain its attractiveness towards PhD students and young engineers. The ratio in terms of supervised students is excellent. In spite of a reduced number of professors in this pole, this does not seem to affect the recruitment of PhD students.

Weaknesses

The number of scientists is under-critical, and teaching staff risks to deteriorate the above strengths. Innovative education programs could probably be promoted.

Assessment of the involvement in training through research

The team has good involvement in training through research. The treated subjects maintain high attractiveness for students. In spite of a reduced number of professors, the ratio in terms of PhD supervised students is excellent. In the future, innovative education programs could be promoted.

CRITERION 2: TEAM ORGANISATION AND LIFE

Strengths

The team works well despite being spread on different sites.

The ratio women/men (around 50%), with the team leader being a woman, is remarkable considering the usual much lower ratios in activities close to technology. The team is attractive to a diversity of students.

Weaknesses

The group counts only 15 permanent members (including 2 emeriti), only 4 research scientists. On top of this, there is now only one permanent position in terms of cleanroom engineers, instead of 4 previously. As for those working on space missions, there is always a risk that some of them do not get funding.

Assessment of the team's life and organization

The structure of the team seems productive, however the team is missing enough scientists which can take a leading role in international collaborations. In spite of a common interest for the same wavelength range and a common site, the integration between the two groups forming the team could be improved.

CRITERION 3: SCIENTIFIC STRATEGY AND PROJECTS

Participations in projects like JUICE and Ice Cloud Imager are highly significant. These projects are well adapted to the groups' strength and expertise. In particular, the Schottky diode developments are very visible on the international level. The developments on the sector of superconducting THz detectors are less obvious in their impact and would strongly profit from a participation in a ground based sub-mm experiment with a more continuous development cycle.

Strengths

The teams capitalize experience from previous space experiments with an excellent track record. The focus on specific subjects is adapted to the small group size and has allowed generating high visibility.

There are numerous scientific projects, for which the two groups are very well prepared.

The expertise in both instrumentation and in remote sensing is quite unique in the French community.

Besides the Schottky receivers, the Instrumentation group is also expert in HEB mixers which are the most sensitive devices around.

Providing earth water budget at global scale and with a fine resolution should impact several socio-economical applications.

Weaknesses

Scientific PI-ships are difficult to generate due to the mainly technical structure of the groups and the low number of permanent senior scientists.

The permanent staff appears rather limited in view of the projects.

The very large diversity of projects is often difficult to handle.

There are several potential future FIR missions in astrophysics which are under discussion, but none of them is currently funded.

Assessment of the scientific strategy and projects

The team has a good focus and strategy for Schottky developments and earth remote observing. The team is involved in highly visible projects. In view of the excellent results obtained so far, it is important to keep on going, and even increase its leadership at an international level; however, it might be necessary to establish priorities due to the rather limited staff.

RECOMMENDATIONS TO THE TEAM

A – Recommendations on scientific production and activities (criterion 1)

The committee recommends to continue and even reinforce the international leadership. Seek collaborative projects which include both sub-groups and strengthen interaction between them in general.

The committee recommends improving on the level of outreach activities, capitalizing on both science and technical expertise.

B – Recommendations on the team's organization and life (criterion 2)

The committee recommends introducing regular exchanges between sub-groups and seek to increase the number of science staff.

C – Recommendations on scientific strategy and projects (criterion 3)

The committee recommends improving the strategy of the group with adequate participation in ground-based experiments, with the goal to mitigate the risks associated with future space missions. Scientific priorities should be established in the view of the limited permanent staff.

Space projects in the THz range seem too sparse to easily allow for continuity, participation in ground based activities with a higher filling factor is recommended.

In general, the developments are more opportunity-driven than following a genuine in-house science strategy. A closer collaboration/interaction between earth observation and detector developments may be able to improve on this problem.

CONDUCT OF THE VISIT

DATES

Start: October 19th 2017 at 8.30 am

End: October 20th 2017 at 5 pm

VISIT SITE

Institution: Institut d'Astrophysique de Paris

Address: 98 bis Boulevard Arago, 75014 Paris

Second site

Institution: Université Pierre et Marie Curie

Address: 4, place Jussieu - 75252 Paris cedex 05

Specific premises visited

Visite bâtiment Lallemand, salle blanche…

CONDUCT OR PROGRAM OF THE VISIT

October 19th 2017, Observatoire de Paris

Horaire	Intitulé	Intervenants	Lieu	Participants
08:30-09:00	Huis clos comité		Amphithéâtre IAP	Comité
09:00-09:15	Introduction HCERES	M. Marcelin	Amphithéâtre IAP	Tous
09:15-10:30	Présentation générale	D. Lis + Direction	Amphithéâtre IAP	Tous
10:30-11:15	Présentation pôle "Galaxies et cosmologie"	F. Combes +	Amphithéâtre IAP	Tous
11:15-12:00	Présentation pôle "Milieu interstellaire et plasmas"	T. Lebertre +	Amphithéâtre IAP	Tous
12:00-12:30	Réunion personnels CNAP	Observateur CNAP	Amphithéâtre IAP	
12:30-14:00	Déjeuner			Comité + invités + tutelles
14:00-14:45	Présentation pôle "Molécules dans l'univers"	F. Dulieu + C. Janssen	Amphithéâtre IAP	Tous
14:45-15:30	Présentation pôle "Instrumentation et télédétection"	C. Prigent +	Amphithéâtre IAP	Tous
15:30-16:00	Huis clos chercheurs / enseignants-chercheurs / post-doctorants		Amphithéâtre IAP	
16:00-17:00	Visite bâtiment Lallemand, salle blanche…	J.-M. Krieg +		Comité + invités + tutelles
17:00-18:00	Huis clos tutelles		Salle du Levant	Comité + tutelles

October 20th 2017, UPMC

Horaire	Intitulé	Intervenants	Lieu	Participants
09:00-10:30	Visite Jussieu	J.-H. Fillion +	319, Tour 32-33	Comité + invités + tutelles
10:30-11:00	Huis clos ITA		509, Tour 24-34	
11:00-11:30	Huis clos doctorants		509, Tour 24-34	
11:30-12:30	Huis clos direction		509, Tour 24-34	
12:30-14:00	Déjeuner			Comité + invités + tutelles
14:00-17:00	Huis clos comité		509, Tour 24-34	
17:00	Fin de la visite statutaire du comité de visite			

SUPERVISING BODIES' GENERAL COMMENTS

l'Observatoire de Paris

Paris, le 20 décembre 2017

la Présidence

PDT C.C/cb/2017-103

HCERES
Monsieur Pierre Glaudes
Directeur de la section
des entités de recherche
2 rue Albert Einstein
75013 PARIS

Recherche
Formation
Culture scientifique

Réf. : DER-PUR190015663 - LABORATOIRE D'ETUDE DU RAYONNEMENT ET DE LA MATIERE EN ASTROPHYSIQUE ET ATMOSPHERES

Objet : Observations générales

Monsieur le Directeur,

Vous trouverez ci-après les observations de portée générale sur le rapport d'évaluation du LERMA.

Je vous prie de croire, Monsieur le Directeur, à l'expression de mes cordiales salutations.

Claude Catala

Président de l'Observatoire de Paris

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Laboratoire d'Etudes du Rayonnement et de la Matière en Astrophysique et Atmosphères

LERMA response to the report of the HCERES Committee

The LERMA management thanks the HCERES Committee for the thoughtful and positive report. The recommendations of the Committee will be carefully considered and discussed with the Laboratory council, the Scientific committee, and the staff in the coming months. We address below several points that, in our opinion, require additional clarification.

- Today's LERMA, just like INSU, is a "sciences of the universe" laboratory, with research and teaching activities in astrophysics, atomic and molecular physics, and Earth science. While not all our research activities are linked to astrophysics, they often share common techniques, notably high-resolution spectroscopy, creating fruitful synergies.
- While the list of LERMA projects is long, they often have very different time scales. Being involved in the preparatory phases of many projects is of paramount importance, as it puts the laboratory at a great advantage in the scientific exploitation of the projects that ultimately come to fruition.
- The public outreach activities are coordinated at the laboratory level by the *Chargé de mission pour communication* (presently Ms Françoise Combes).
- Concerning the Ph.D. students, their follow-up is organized at the level of doctoral schools, e.g., ED127, and the statistics are available through the ADUM application. All the staff, including students, was encouraged to participate in the closed meetings with the HCERES committee.
- Concerning the organization of the engineering staff, LERMA engineers work in close collaboration with the researchers responsible for the scientific coordination of the projects. Consequently, they are assigned to one of the scientific poles. This organization provides optimum support to the projects.
- Concerning the administrative and IT support teams, staff departures are typically replaced with a significant delay, leading to a temporary increase in the workload. In addition, the IT support salaries are not competitive with the private sector and finding suitable candidates is difficult. On a positive note, the new financial administrator has now arrived at the laboratory.
- LERMA has been actively seeking participation in ground-based submillimeter instrumentation projects. Current projects under discussion include the DATE5 telescope on Dome A (Chinese Center for Antarctic Astronomy) and the *Leighton Chajnanor Telescope* (Caltech, Chinese Academy of Sciences, Shanghai Normal University, and Universidad de Conception).
- In addition to the general organization chart, detailed organizational charts do exist for the technical, administrative, and IT support staff.
- The future evolution of the ENS Physics Department is indeed a major concern for the LERMA management. We do hope that new organization will not impede the fruitful, long-term scientific collaborations that are currently in place.
- Safety procedures are regularly reviewed by the managing institutions (e.g., LERMA premises at the Paris Observatory were last inspected by the newly appointed *Conseiller de prévention* in August of 2017). Recommendations are implemented to ensure compliance. In particular, the new *Référent sécurité laser* at UPMC is currently registered for the training required.

We include below several additional clarifications provided by the specific teams.

Team 2: Interstellar medium and plasmas

- Although the team is spread over 4 different locations, it is not organized geographically. The three main research topics involve staff from different locations. This is both a weakness and an asset, as it facilitates interactions between diverse groups and disciplines, and attracts high-quality students.
- *Machine Learning Techniques* is a new line of research that the laboratory is actively developing, strategic for scientific exploitation of the large volumes of observational data and theoretical models. The limited manpower (both researchers and technical personnel) is a factor that has been communicated to the managing institutions.
- The activities in plasma physics are federated by the Labex Pas@Par and cover mainly the *Interstellar medium and plasmas* team, but also the *Molecules in the universe* team (V/UV spectrometer and

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atomic databases, see below). A strong network of collaborations exists within the laboratory, as well as at national and international levels. Specific projects of general interest for LERMA include the code development for laboratory and astrophysical plasmas.

- Our numerous outreach activities and interactions with the non-academic world are listed in the HCERES document (page 23). Moreover, the committee's comment, "the strong interest for interdisciplinary outreach (Art & Sciences) creating connection with the civil society" (page 7), should be attributed primarily to the plasma group within the Labex Plas@Par.
- The importance of SKA for the studies of magnetic fields and circumstellar environments was emphasized in the oral presentation before the Committee.

Team 3: Molecules in the universe

- Plasma activities within the *Molecules in the universe team* include database operation and development, as well as laboratory spectroscopy of multiply charged ions. These studies have immediate applications for astrophysics: Fe V, Ni V for investigating the variability of fundamental constants through HST observations of white dwarfs; Eu, Er, Tm ions for abundance studies and radiative transfer simulations in neutron star merger ejecta.
- Not all activities in the group are directly linked to astrophysical research. An important part of the activity is dedicated to the study of Earth's atmospheric composition, in particular to greenhouse gases like CO_2 and CH_4, but also to chemical pollutants, such as O_3. These activities have high socio-economic impact, not reflected by the indicators used in the assessment.
- Much of the advanced laboratory instrumentation, such as the frequency comb based MIR spectrometer or the UV spectrograph are required for generation of precise and traceable spectroscopic data, which are essential for Earth observations and studies of the variability of the fundamental physical constants over cosmological time scales.

Team 4: Instrumentation and remote sensing

- Despite the small number of scientists in this team, several key international projects are currently led by the team members, including the HERO instrument for the *Origins Space Telescope*, as well as the MICROWAT mission submitted to the ESA Earth Explorer 10 call.
- The instrumentation group actively seeks participation in new ground-based and space projects with China, such as HSTDM on the Chinese space station or DATE5 at Dome A.
- The instrumentation and remote sensing groups are both located on the same site (Paris Observatory). We had several small joint projects in the past, such as the ESA hyperspectral project. Larger joint projects were also proposed to CNES and ESA, but ultimately not selected. Future opportunities will be actively pursued.
- The outreach activities and socio-economic interactions of the team are impacted by the small number of researchers. However, research activities related to studies of the water and energy cycle, weather forecasting, flooding susceptibility, etc., all have direct, long-term impact on the society.

APPENDICES

Scientific outputs and activities, academic reputation and appeal From 01/01/2012 to 30/06/2017	Number
Articles: scientific articles	1157
Articles: review articles	N/A
Books: monographs, critical editions, translations	8
Books: scientific book edition	2
Books: book chapters	1
Books: published/edited theses	38
Meetings: conference proceedings	20
Symposia, meetings: articles in meeting proceedings	N/A
Meetings: other conference outputs	N/A
Academic research grants: European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants	14
Academic research grants: national public grants (ANR, PHRC, FUI, INCA, etc.)	45
Academic research grants: local grants (collectivités territoriales)	5
Academic research grants: PIA (Labex, Equipex etc.) grants	8
Academic research grants: grants from foundations and charities (ARC, FMR, FRM, etc.)	N/A
Visiting scientists, post-docs	170
Electronic tools and products: softwares	19
Electronic tools and products: libraries and cohorts	5
Electronic tools and products: corpus	N/A
Electronic tools and products: tools presented in solver competitions	N/A
Electronic tools and products: decision tools	N/A
Editorial activities: participation to journal editorial boards (books, collections)	3
Editorial activities: collection or series editor	0

Peer reviewing activities: participation to institutional committees and juries (CNRS, INSERM, etc.)	N/A
Peer reviewing activities: reviewing of journal articles	N/A
Peer reviewing activities: participation to lab site visit committees (HCERES etc.)	N/A
Peer reviewing activities: grant evaluation (public or charities)	N/A
Scientific recognition: prizes	4
Scientific recognition: distinctions	8
Scientific recognition: chair of learned and scientific societies	N/A
Scientific recognition: invitations to meetings and symposia (out of France)	142

Interactions with the non-academic world, impacts on economy, society, culture or health **From 01/01/2012 to 30/06/2017**	**Number**
Technical expert or standardization reports	0
Socio-economic interactions: industrial and R&D contracts	3
Socio-economic interactions: Cifre fellowships	1
Socio-economic interactions: creation of labs with private-public partnerships	0
Socio-economic interactions: networks and mixed technological units	0
Socio-economic interactions: start-ups	1
Socio-economic interactions: patents, licenced patents and inventions	1
Public outreach: radio broadcasts, TV shows, magazines	11
Public outreach: journal articles, interviews, book edition, videos, etc.	14
Public outreach: other popularization outputs	N/A
Public outreach: debates on science and society	5

Involvement in training through research **From 01/01/2012 to 30/06/2017**	**Number**
Habilitated (HDR) scientists	43
PhD students	78

Defended PhDs	38
Mean PhD duration	N/A
Mean number of publications per student	N/A
Educational outputs: books	0
Educational outputs: e-learning, MOOCs, multimedia lessons, etc.	7

Unit organisation and life From 01/01/2012 to 30/06/2017	**Number**
Women/men ratio in the unit	37/72
Women/men ratio among unit scientists	21/42
Women/men ratio among unit PhD students	27/51
Women/men ratio among team leaders, unit head and deputy heads.	N/A

Team 1:

Scientific outputs and activities, academic reputation and appeal From 01/01/2012 to 30/06/2017	**Number**
Articles: scientific articles	410
Articles: review articles	0
Books: monographs, critical editions, translations	2
Books: scientific book edition	1
Books: book chapters	0
Books: published/edited theses	5
Meetings: conference proceedings	7
Symposia, meetings: articles in meeting proceedings	0
Meetings: other conference outputs	0
Academic research grants: European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants	2
Academic research grants: national public grants (ANR, PHRC, FUI, INCA, etc.)	11

Academic research grants: local grants (collectivités territoriales)	1
Academic research grants: PIA (Labex, Equipex etc.) grants	0
Academic research grants: grants from foundations and charities (ARC, FMR, FRM, etc.)	0
Visiting scientists, post-docs	50
Electronic tools and products: softwares	2
Electronic tools and products: libraries and cohorts	1
Electronic tools and products: corpus	No
Electronic tools and products: tools presented in solver competitions	0
Electronic tools and products: decision tools	0
Editorial activities: participation to journal editorial boards (books, collections)	1
Editorial activities: collection or series editor	0
Peer reviewing activities: participation to institutional committees and juries (CNRS, INSERM, etc.)	Yes
Peer reviewing activities: reviewing of journal articles	Yes
Peer reviewing activities: participation to lab site visit committees (HCERES etc.)	Yes
Peer reviewing activities: grant evaluation (public or charities)	Yes
Scientific recognition: prizes	2
Scientific recognition: distinctions	4
Scientific recognition: chair of learned and scientific societies	Yes
Scientific recognition: invitations to meetings and symposia (out of France)	2

Interactions with the non-academic world, impacts on economy, society, culture or health From 01/01/2012 to 30/06/2017	Number
Technical expert or standardization reports	0
Socio-economic interactions: industrial and R&D contracts	0
Socio-economic interactions: Cifre fellowships	0
Socio-economic interactions: creation of labs with private-public partnerships	0
Socio-economic interactions: networks and mixed technological units	0
Socio-economic interactions: start-ups	0
Socio-economic interactions: patents, licenced patents and inventions	0
Public outreach: radio broadcasts, TV shows, magazines	4
Public outreach: journal articles, interviews, book edition, videos, etc.	7
Public outreach: other popularization outputs	No
Public outreach: debates on science and society	1

Involvement in training through research From 01/01/2012 to 30/06/2017	Number
Habilitated (HDR) scientists	8,5
PhD students	17
Defended PhDs	5
Mean PhD duration	N/A
Mean number of publications per student	N/A
Educational outputs: books	0
Educational outputs: e-learning, MOOCs, multimedia lessons, etc.	1

Team organisation and life From 01/01/2012 to 30/06/2017	Number
Women/men ratio in the team	4,5/8
Women/men ratio among team scientists	4,5/6
Women/men ratio among team PhD students	8/9

Team 2:

Scientific outputs and activities, academic reputation and appeal From 01/01/2012 to 30/06/2017	Number
Articles: scientific articles	484
Articles: review articles	1
Books: monographs, critical editions, translations	5
Books: scientific book edition	0
Books: book chapters	1
Books: published/edited theses	18
Meetings: conference proceedings	4
Symposia, meetings: articles in meeting proceedings	0
Meetings: other conference outputs	0
Academic research grants: European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants	1
Academic research grants: national public grants (ANR, PHRC, FUI, INCA, etc.)	11
Academic research grants: local grants (collectivités territoriales)	N/A
Academic research grants: PIA (Labex, Equipex etc.) grants	1
Academic research grants: grants from foundations and charities (ARC, FMR, FRM, etc.)	0
Visiting scientists, post-docs	63,5
Electronic tools and products: softwares	6
Electronic tools and products: libraries and cohorts	2
Electronic tools and products: corpus	No

Electronic tools and products: tools presented in solver competitions	0
Electronic tools and products: decision tools	0
Editorial activities: participation to journal editorial boards (books, collections)	1
Editorial activities: collection or series editor	0
Peer reviewing activities: participation to institutional committees and juries (CNRS, INSERM, etc.)	Yes
Peer reviewing activities: reviewing of journal articles	Yes
Peer reviewing activities: participation to lab site visit committees (HCERES etc.)	No
Peer reviewing activities: grant evaluation (public or charities)	Yes
Scientific recognition: prizes	2
Scientific recognition: distinctions	1
Scientific recognition: chair of learned and scientific societies	Yes
Scientific recognition: invitations to meetings and symposia (out of France)	53

Interactions with the non-academic world, impacts on economy, society, culture or health From 01/01/2012 to 30/06/2017	Number
Technical expert or standardization reports	0
Socio-economic interactions: industrial and R&D contracts	0
Socio-economic interactions: Cifre fellowships	0
Socio-economic interactions: creation of labs with private-public partnerships	0
Socio-economic interactions: networks and mixed technological units	0
Socio-economic interactions: start-ups	0
Socio-economic interactions: patents, licenced patents and inventions	0
Public outreach: radio broadcasts, TV shows, magazines	6
Public outreach: journal articles, interviews, book edition, videos, etc.	4
Public outreach: other popularization outputs	No
Public outreach: debates on science and society	0

Involvement in training through research From 01/01/2012 to 30/06/2017	Number
Habilitated (HDR) scientists	19
PhD students	30,5
Defended PhDs	18
Mean PhD duration	N/A
Mean number of publications per student	N/A
Educational outputs: books	0
Educational outputs: e-learning, MOOCs, multimedia lessons, etc.	4

Team organisation and life From 01/01/2012 to 30/06/2017	Number
Women/men ratio in the team	8/19,5
Women/men ratio among team scientists	6/16
Women/men ratio among team PhD students	8,5/22

Team 3:

Scientific outputs and activities, academic reputation and appeal From 01/01/2012 to 30/06/2017	Number
Articles: scientific articles	173
Articles: review articles	0
Books: monographs, critical editions, translations	1
Books: scientific book edition	1
Books: book chapters	0
Books: published/edited theses	5
Meetings: conference proceedings	2
Symposia, meetings: articles in meeting proceedings	0
Meetings: other conference outputs	0
Academic research grants: European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants	5
Academic research grants: national public grants (ANR, PHRC, FUI, INCA, etc.)	8
Academic research grants: local grants (collectivités territoriales)	4
Academic research grants: PIA (Labex, Equipex etc.) grants	7
Academic research grants: grants from foundations and charities (ARC, FMR, FRM, etc.)	0
Visiting scientists, post-docs	38
Electronic tools and products: softwares	9
Electronic tools and products: libraries and cohorts	1
Electronic tools and products: corpus	No

Electronic tools and products: tools presented in solver competitions	0
Electronic tools and products: decision tools	0
Editorial activities: participation to journal editorial boards (books, collections)	1
Editorial activities: collection or series editor	0
Peer reviewing activities: participation to institutional committees and juries (CNRS, INSERM, etc.)	Yes
Peer reviewing activities: reviewing of journal articles	Yes
Peer reviewing activities: participation to lab site visit committees (HCERES etc.)	No
Peer reviewing activities: grant evaluation (public or charities)	Yes
Scientific recognition: prizes	0
Scientific recognition: distinctions	0
Scientific recognition: chair of learned and scientific societies	No
Scientific recognition: invitations to meetings and symposia (out of France)	79

Interactions with the non-academic world, impacts on economy, society, culture or health From 01/01/2012 to 30/06/2017	Number
Technical expert or standardization reports	2
Socio-economic interactions: industrial and R&D contracts	0
Socio-economic interactions: Cifre fellowships	0
Socio-economic interactions: creation of labs with private-public partnerships	0
Socio-economic interactions: networks and mixed technological units	0
Socio-economic interactions: start-ups	0
Socio-economic interactions: patents, licenced patents and inventions	0
Public outreach: radio broadcasts, TV shows, magazines	1
Public outreach: journal articles, interviews, book edition, videos, etc.	3
Public outreach: other popularization outputs	2
Public outreach: debates on science and society	0

Involvement in training through research From 01/01/2012 to 30/06/2017	Number
Habilitated (HDR) scientists	12
PhD students	11,5
Defended PhDs	5
Mean PhD duration	N/A
Mean number of publications per student	N/A
Educational outputs: books	0
Educational outputs: e-learning, MOOCs, multimedia lessons, etc.	2

Team organisation and life From 01/01/2012 to 30/06/2017	Number
Women/men ratio in the team	9/16
Women/men ratio among team scientists	8/13
Women/men ratio among team PhD students	3,5/8

Team 4:

Scientific outputs and activities, academic reputation and appeal From 01/01/2012 to 30/06/2017	Number
Articles: scientific articles	90
Articles: review articles	0
Books: monographs, critical editions, translations	0
Books: scientific book edition	0
Books: book chapters	0
Books: published/edited theses	10
Meetings: conference proceedings	7
Symposia, meetings: articles in meeting proceedings	0
Meetings: other conference outputs	0
Academic research grants: European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants	6
Academic research grants: national public grants (ANR, PHRC, FUI, INCA, etc.)	15
Academic research grants: local grants (collectivités territoriales)	0
Academic research grants: PIA (Labex, Equipex etc.) grants	0
Academic research grants: grants from foundations and charities (ARC, FMR, FRM, etc.)	0
Visiting scientists, post-docs	17,5
Electronic tools and products: softwares	2
Electronic tools and products: libraries and cohorts	1
Electronic tools and products: corpus	No

Electronic tools and products: tools presented in solver competitions	0
Electronic tools and products: decision tools	0
Editorial activities: participation to journal editorial boards (books, collections)	0
Editorial activities: collection or series editor	0
Peer reviewing activities: participation to institutional committees and juries (CNRS, INSERM, etc.)	Yes
Peer reviewing activities: reviewing of journal articles	Yes
Peer reviewing activities: participation to lab site visit committees (HCERES etc.)	No
Peer reviewing activities: grant evaluation (public or charities)	Yes
Scientific recognition: prizes	0
Scientific recognition: distinctions	3
Scientific recognition: chair of learned and scientific societies	No
Scientific recognition: invitations to meetings and symposia (out of France)	80

Interactions with the non-academic world, impacts on economy, society, culture or health From 01/01/2012 to 30/06/2017	Number
Technical expert or standardization reports	0
Socio-economic interactions: industrial and R&D contracts	3
Socio-economic interactions: Cifre fellowships	1
Socio-economic interactions: creation of labs with private-public partnerships	0
Socio-economic interactions: networks and mixed technological units	0
Socio-economic interactions: start-ups	1
Socio-economic interactions: patents, licenced patents and inventions	1
Public outreach: radio broadcasts, TV shows, magazines	1
Public outreach: journal articles, interviews, book edition, videos, etc.	0
Public outreach: other popularization outputs	No
Public outreach: debates on science and society	4

Involvement in training through research From 01/01/2012 to 30/06/2017	Number
Habilitated (HDR) scientists	7,5
PhD students	19
Defended PhDs	10
Mean PhD duration	N/A
Mean number of publications per student	N/A
Educational outputs: books	0
Educational outputs: e-learning, MOOCs, multimedia lessons, etc.	0

Team organisation and life From 01/01/2012 to 30/06/2017	Number
Women/men ratio in the team	7,5/13,5
Women/men ratio among team scientists	1,5/5,5
Women/men ratio among team PhD students	7/12

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