Research evaluation

EVALUATION REPORT OF THE UNIT

LCF – Laboratoire Charles Fabry

UNDER THE SUPERVISION OF THE FOLLOWING ESTABLISHMENTS AND ORGANISMS:

Institut d'Optique Graduate School – IOGS

Centre national de la recherche scientifique – CNRS

Université Paris Saclay – U Paris Saclay

EVALUATION CAMPAIGN 2024-2025

GROUP E

Rapport publié le 23/05/2025

High Council for evaluation of research and highter education

In the name of the expert committee:

Barend Van Tiggelen, chairman of the committee

For the Hcéres:

Coralie Chevallier, 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:	Mr Barend Van Tiggelen, Centre national de la recherche scientifique, Grenoble
Experts:	Mr Oualid Chaibi, Centre national de la recherche scientifique, Nice Mr Sukhdeep Dhillon, Centre national de la recherche scientifique, Paris (representative of the CoNRS) Mr Olivier Haeberlé, Université de Haute-Alsace, Mulhouse Ms Patricia Segonds, Université Grenoble Alpes (representative of the CNU) Mr Sébastien Weber, Centre national de la recherche scientifique, Toulouse (research support personnel) Mr David Wilkowski, Université Côte d'Azur/ Nanyang Technological University, Singapour

HCÉRES REPRESENTATIVES

Ms Laurence Pruvost

REPRESENTATIVES OF SUPERVISING INSTITUTIONS AND BODIES

Mr Rachid Benacer, Université Paris-Saclay
Ms Maria-Pilar Bernal Artajona, CNRS Ingénierie
Mr Rémi Carminati, IOGS
Ms Saida Guellati-Kelifa, CNRS Physique
Mr Denis Merlet, Université Paris-Saclay

CHARACTERISATION OF THE UNIT

- Name: Laboratoire Charles Fabry
- Acronym: LCF
- Label and number: UMR 8501
- Number of teams: Nine teams
- Composition of the executive team: Mr Patrick Georges (Director), Mr Philippe Grangier and Mr Chris Westbrook (Deputy Directors)

SCIENTIFIC PANELS OF THE UNIT

ST: Science and Technology
ST2: Physics
ST6: Information and Communication Science and Technology – STIC
ST5: Engineering Science

THEMES OF THE UNIT

The LCF is a research unit working in the field of optics, interactions between light and atoms as well as between other matter and light (summarized as photonics). It houses the entire scientific chain from fundamental theoretical, computational and experimental activities towards a huge interface of applications and industry collaboration. Even if the LCF pretends not to cover all aspects in optics it is certainly active on a broad cutting edge of optics. The research activity is divided into 8 teams with well-defined and quite orthogonal topics: 1) many-body properties of ultracold quantum gases, 2) quantum optics and quantum simulation using atoms arrays and media densely filled with atoms, 3) foundation of quantum optics, 4) ultrafast laser sources and new designs of strong, pulsed laser sources such as the Apollon Peta-Watt laser, 5) light-matter interactions on the nanoscale such as the role of static or quasi-modes for nano-antennes, plasmonics, 6) radiative heat transfer at nanoscales, nonlinear photonic waveguides, 7) in-vivo functional imaging based on optical coherence tomography, 8) speckle contrast and fluorescence microscopy, 9) the often co-conceptive design of innovative numerical algorithms and adaptive optics for remote sensing and astronomical observations, 10) fiber communications, and 11) multilayer components to manipulate the propagation of X-ray and UV light. A new team on "Industrial Photonics" has been created during the last term that works on freeform optics inspired by requests coming from industrial partners.

HISTORIC AND GEOGRAPHICAL LOCATION OF THE UNIT

The Institut d'Optique was founded more than one century ago and was equipped with a research department that became associated with CNRS (« laboratoire associé au CNRS ») in 1966 and was baptized « Laboratoire Charles Fabry » in 1998. The LCF was affiliated with the University of Paris, later with University Paris-Sud 11 when it moved to Orsay. In 2006 the Institute was re-baptized Institut d'Optique Graduate School (IOGS) and moved with the LCF from the Orsay Plateau to a new building in Palaiseau. It got a total surface 14.400 m2, much larger than before in Orsay. In this building, the LCF occupies roughly 6700 m2. The Institut d'Optique operates under the by-law "établissement privé d'enseignement supérieur et de recherche, reconnu d'utilité publique", with private status. Recently the IOGS has become a component of the University Paris-Saclay.

Today, the LCF is a mixed research unit (UMR) with IOGS, CNRS and UPSaclay as scientific authorities and IOGS as owner of the premises. On CNRS side both CNRS Physique and CNRS Ingénierie pilot the unit on an equal footing. The IOGS is authority of two other mixed units working on optics, one in Talence (LP2N) and one in Saint-Etienne (LHC). With the creation of the LP2N, CNRS and IOGS decided in 2014 to create a joint mixed service units (UMS) to handle all administrations, but this unit was closed in 2021. The LCF is an active and highly visible partner in the rich Paris-Saclay scientific landscape.

RESEARCH ENVIRONMENT OF THE UNIT

With the creation of the Université Paris-Saclay (UPSaclay) in 2019, supported by the "Programme d'Investissement d'Avenir" (PIA), and the integration of IOGS as a component, the LCF has become part of one of the most innovative and most excellent scientific research environments in the world. Numerous opportunities and collaborations exist locally, including some unique large research facilities such as the Apollon laser infrastructure and the Soleil synchrotron. The LCF has actively participated in two Labex (Laboratoire d'Excellence) programs that provided scholarships and resources for equipment, and three Equipex (Equipement d'Excellence) programs. The LCF is actively involved in two (among 17) Graduate Schools of UPSaclay (Physics and Engineering & System Sciences). A transverse Institute for the Sciences of Light (ISL) exists at UPSaclay directed by a member of LCF. The LCF is affiliated with two Doctoral Schools: EDOM (ED572), EOBE (ED 575). Being highly engaged in the valorisation of its research output, the LCF has strong ties with the local SATT (Société d'Accélération du Transfert de Technologies).

On the regional level of Île-de-France, the LCF has been involved in the steering of the DIM (Domaine de recherche et d'Innovation Majeur) on Quantum Technologies SIRTEQ as well as its successor QUANTIP. On a

national level, LCF benefitted from two PEPR programs (Programme et Equipements Prioritaires de Recherche): one on quantum simulation with cold atoms and one on adaptive optics. Finally, the LCF is a contributing partner in several large international consortiums such as the Very Large Telescope (VLT) of the European Southern Observatory and its successor, the Extreme Large Telescope (ELT), that is under construction in Chili. Several eminent staff members of LCF are active in the execution of the European Quantum Flagship Initiative.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	12
Maîtres de conférences et assimilés	14
Directeurs de recherche et assimilés	11
Chargés de recherche et assimilés	5
Personnels d'appui à la recherche	22
Sous-total personnels permanents en activité	**64**
Enseignants-chercheurs et chercheurs non permanents et assimilés	2
Personnels d'appui non permanents	1
Post-doctorants	10
Doctorants	52
Sous-total personnels non permanents en activité	**65**
Total personnels	**129**

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	C	PAR
CNRS	0	16	19
U Paris Saclay	25	0	1
IOGS	0	0	2
Others	1	0	0
Total personnels	**26**	**16**	**22**

GLOBAL ASSESSMENT

The LCF hosts scientific activities on optics that cover the entire chain from fundamental physics and engineering to modern applications, with a strong involvement inside all teams of entrepreneurship and transfer to applications in e.g. remote sensing, medical imaging, biophysics, solar physics and synchrotron platforms. The unit's scientific excellence and innovation, as well as its technological creativity radiate far and wide, with certain activities having a worldwide reputation, such as the ones on quantum technologies (the founder of Group 1 was awarded the 2022 Nobel Prize in Physics), laser sources and XUV optics. The technical and technological developments that emerge from exemplary collaborations between scientists and technicians, are of an unprecedented level, unique in France. High-level scientific activity is developed and nourished by an impressive pool of doctoral students coming from different Master programs of the IOGS, the University of Paris-Saclay, the Grandes Ecoles in France and from abroad. They are supported by significant own resources obtained via national and international calls for tender as well as by revenues obtained from industry.

Given 1) the large diversity of themes and methods, 2) the creation of the University of Paris-Saclay of which the IOGS has become a component, 3) the hectic elimination of the IOGS/CNRS (UMS) unit that was managing the administrations of the joint units of IOGS and CNRS in both Palaiseau, Talence and Saint-Etienne, and 4) the severe constraints in human resources of the crucial IOGS proximity services, the LCF management has faced a difficult mission which has been accomplished with goodwill and efficiency, supported by the continuous support from the three supervisory authorities.

The committee welcomes the arrival of a new administrative manager in 2025 and hopes that a serene administration will be established to the satisfaction of all, exempt from overload and with fluid, transparent communication with the IOGS services. The groups of LCF benefit from a significant autonomy in their scientific strategy, and cover different themes, without too much scientific overlap, though with shared support. Indeed, they all rely significantly on the technical services and do this in good mutual coordination. Some groups consist of several teams that are fragile because either subcritical or run by only one or two faculty members with a significant teaching and administrative load. Unfortunately, some of them only have team leaders and no spokesman exists for the entire group, but the synergy observed within the groups is a positive point that reinforces their internal coherence. The committee welcomes the new activity on industrial photonics which relies on an association of companies, and which reconfirms one of the objectives of the LCF to be a major player in the transfer of knowledge and technological competences. The decision by the LCF management to assign the upcoming recruitment of an engineer at the University Paris-Saclay to this group is strongly supported.

DETAILED EVALUATION OF THE UNIT

A - CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

"Where possible, the unit should seek to increase the availability of the irreplaceable skills of the LCF's technical services to other laboratories, industry and, in particular, startups and for apprentices. The construction of highly complex experimental set-up cannot be completely outsourced, as the necessary skills are not necessarily available in industry. It is conceivable that the Laboratory's workshops, once strengthened and made permanent, will be able to provide an even greater service to optics/photonics manufacturers, particularly startups, thanks to their unique and irreplaceable skills. They will also be able to play a greater role in training and for apprentices."

The technical services at LCF constitute a real treasure and provide precious and highly customized skills that are often not available anywhere else in France. These skills are heavily solicited inside the unit and its emerging startups, whereas at the same time trained employees become harder to find. As a result, sharing the services to the outside is not a priority of LCF. Nevertheless, several technical platforms and support services deliver external services. The CEMOX facility (Centrale d'Elaboration et de Métrologie d'Optique X) can be accessed upon demand and with charges. The optical workshop has started to respond again to outside requests whenever possible.

"Given the strong structural link with its local supervisory institution, the committee recommends that communication between the IOGS and LCF structures be strengthened."

This item is still a matter of great concern, and mostly applies to the technical, administrative and network support units of IOGS and LCF that have to work together every day.

"The unit should be even more proactive about gender balance, for example in the functions of collective interest to the laboratory."

Gender balance is still not established and two CNRS female agents unfortunately left LCF. The LCF is aware of this ubiquitous problem and quite active with its program "Femmes and Sciences" that recognizes that the issue of gender parity must be solved by promoting physics in the early stages of education.

"The unit will have to ensure that it maintains a high level of activity in all areas and a balanced development of its teams. It will also have to maintain the balance between fundamental, applied and technological research, one of the LCF's great strengths."

Fostering and keeping this balance is a real challenge. The unit has been exemplary in this matter

"Care must be taken not to multiply the number of research lines within each group, and to refocus on the most promising objectives. In any case, it will be necessary to develop more international collaboration networks and exchanges of researchers at all levels."

The unit has been exemplary in this matter, but some (sub-) teams have permanent work power consisting of only one or two equivalent time for research (ETPR) and many more themes or projects.

"The LCF will have to take advantage of the new scientific environment created by the development of Paris-Saclay by organizing more collaborations between the unit's teams and those of the new establishments setting up on the plateau."

The unit works hard to accomplish ties with UPSaclay, that is still in its starting phase. Nevertheless, this recommendation will be reconducted.

"LCF will have to foster a scientific watch function to identify emerging themes of great potential that have not yet been developed at the LCF, and which might otherwise be missed due to the otherwise highly effective logic of internal scientific development within the teams."

The watch function is carried out by the different individual teams and no laboratory strategy exists. They seem to be very successful. Nevertheless, a new scientific team on freeform optics has been created, supported by the LCF management.

B - EVALUATION AREAS

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

Assessment on the scientific objectives of the unit

The LCF conducts research in optics (summarizing all topics on propagation and manipulation of electromagnetic waves) and photonics (summarizing in a broad sense all aspects of interactions between light and matter), both addresssing quantum and classical properties. The major objective is not to cover all themes in optics but rather an entire chain between identified fundamental concepts and innovative applications, with a clear priority to stay on the cutting edge of worldwide research. The training on master/engineer and doctoral level is a second clearly specified objective, with the proximity of both research and innovation.

Assessment on the unit's resources

The LCF is successful in grant applications on both regional, national and European level and has enough financial resources.

It has access to and is deeply involved in the operation of unique platforms to conduct edge-cutting research, some in-house, some external and shared (Thales R&T, C2N).

The ratio of permanent support to permanent research (more than 50%) is large compared to other physics units which highlights the important role of the technical (18) and administrative support (4) at LCF

Assessment on the functioning of the unit

The LCF has a management team (a director and two deputy directors) assisted by an administrative staff. During the period, the administrative head ("responsable administratif") was leaving occurring some troubles. A solution (recruitment) has been brought by CNRS, just before the evaluation.

The unit is well-structured: eight scientific teams, one being recently created team on Industrial Photonics, a large technical service unit, split up into six different services and the administration supports. The dispatch of technical staff to projects is auto-organized without too much interference from the management. The service unit is in charge of access to platforms as the in-house CeMOX facility (supervised by the XUV team and an engineer) or the nanofabrication facility at the close by C2N unit, as well as a lithography facility housed next-door by Thales.

The LCF depends also on the DDS (Direction des Services) of IOGS mainly because the DDS deals with most of contracts brought by the LCF but also by a CNRS member in charge of the network who is assigned to the DDS in agreement with the CNRS Physique.

The laboratory council represents all staff, students and postdocs. They gather about six times per year. A second council gathers the scientific team leaders whenever necessary but is often set up simultaneously with the laboratory council.

1/ The unit has set itself relevant scientific objectives.

Strengths and possibilities linked to the context

The LCF covers a large variety of contemporary subjects in optics and photonics, ranging from ultracold atoms, quantum optics, nanophotonics, medical imaging, space science to new generation lasers. Not only does it excel in most of them at an international level but the large variety of in-house scientific methods and innovative experiments is also impressive.

The portioning into teams with clearly separate topics while sharing platforms and services is a sign of efficient organisation.

The platforms CeMOX is one of a kind, and several service units have no equivalent expertise anywhere else.

The LCF and its supervising body IOGS want to be on the forefront of both training-through-research and of research for innovation and even their mixture. Here, the outcome is outstanding.

The Nobel Prize, as well as several other prestigious prizes awarded during the last mandate to LCF collaborators, and the creation of several startups largely testify this conclusion

Weaknesses and risks linked to the context

The technical service unit is of high excellence but is also precarious, due not only to the significant pay-roll difference with private companies but also suffering from the difficulty of recruiting qualified staff. The service has undergone a significant reorganisation (4 retirements, 1 departure, 7 recruitments out of the 18 technical permanent staff present during the evaluation).

The administrative desk of LCF was created in 2021 after the tumultuous closure of the UMS, when the LCF director had to take up the role of head of administration. No less than three BAP J administrators appointed by CNRS left LCF after a year or less. Currently, most administration is carried out by the DDS at IOGS but concerning the communication lines between IOGS and LCF administration, a large room for improvement exists.

Five senior scientists will retire in the next term, and two new faculty recruitments will be reassigned to IOGS and probably to LCF. Although there has been a fresh recruitment of four associate professors (maitres des conférences) in three different sections of CNU, only two associate researchers (Chargés de Recherche) have been recruited. This is surprisingly low given the high attractivity of LCF and its strong affiliation with sections 04 and 08 of the CoNRS. This is partly explained by the existence of nearby companies that attract potential candidates with competitive salaries.

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 LCF receives roughly 340 k€ on recurrent funding from its 3 authorities, mostly from CNRS (245 k€ on average, somewhat fluctuating), 60 k€ from IOGS and 20 k€ from UPSaclay as of 2020 when it was created. This recurrent budget is used to cover some running costs and several isolated supports to equipment and staff. Most of the financial resources come from calls for tender that result in own resources that fluctuated annually between 2.2 M€ and 3.7 M€, with 45% coming from ANR calls, including PEPR. The infrastructure costs of 1.15 M€ are directly paid by IOGS who takes 25% overheads on contracts. Contract income fluctuates significantly between teams with roughly 60% coming from the teams "Quantum Gases" and "Quantum Optics". Most of this income stems from national (ANR) and international (ERC) grants. Financial resources from contracts are assigned directly to the PI's and no internal share takes place. Each year an amount of roughly 200 k€ (5% of total own resources) is obtained from patents, industrial collaborations and service contracts with a significant part brought in by the new team "Industrial Photonics". Some contracts are administered by the DR4 of the CNRS, in particular the ERC of CNRS agents. The CNRS takes 25% overhead and transfers 17% to the IOGS to cover running costs.

At the time of the visit, the LCF counted 25 faculty staff members (13 Equivalent Time Research ETPR), 23 employed by UPSaclay/IOGS (the slash indicates that these people are officially part of UPSaclay faculty staff but keep their affiliation with IOGS, one from UPSaclay and one from University Sorbonne Paris-Nord, seventeen CNRS researchers and 22 staff members for technical and administrative support (among which 19 employed by CNRS). The technical support unit suffered from the departure of five agents including a highly qualified optical polisher. The administrative support unit went through turbulent times with the closure of the Unité Mixed de Service (UMS) of CNRS and IOGS in 2021 that handled both the LCF and the LP2N in Bordeaux. This initiated a difficult reorganization process with the absence of a qualified head of administration that will finally arrive in January 2025. Many administrative tasks are carried out by the IOGS administration, i.e. are external to LCF.

To optimize the research for innovation many local opportunities have been seized, such as the support of the local SATT, the presence of the common research laboratory with the company Amplitude (compression of ultrafast laser pulses, whose product COMPRESS originates from a shared development), and the creation of two startups (Damae medical developing a spectroscopic Line-field Confocal Optical Coherence Tomography for cancer diagnosis improvement in dermatology, and Pasqal, developing quantum simulators with Rydberg atoms). Several other startups are in the pipeline such as UNVEIL on interferometric microscopy for the detection of nanoparticules of biological interest like in small tumours.

The LCF is involved in a number of large "co-conceptive" projects such as SOLAR C (spectroscopic imaging of the Sun in the extreme UV (2028), VIGIL that will investigate solar eruptions (2031) and the optimal control for the adaptive optics of the ELT first light ESO instrument (planned for 2029).

No less than 87 PhD theses have been defended, supported by 17 scholarships from Cifre (with industrial partners), several with "monitorats" linked to Grandes Ecoles in Paris intramuros, UPSaclay and Lyon, as well as by scholarships of two graduate schools of UPSaclay.

A huge strength is the building in Palaiseau, well maintained and highly adapted to the activity of LCF. It is located in front of the Thales building, a major industrial partner, and close to the main buildings of the University of Paris-Saclay. Unlike in many other units intra- and extra-muros, no space problem exists.

Weaknesses and risks linked to the context

The teams at LCF are highly autonomous and actions mobilizing the entire unit (out wall sessions, regular seminar) are rare and intermittent.

The wealth of the LCF is not equally distributed among the teams.

The technical support is precious, required competences are highly specialized and rare and therefore precarious, threatened by attractive salaries in the private sector.

The administration desk is understaffed, subject to turn-over and without a person in charge other than the director itself.

Four teams (XUV Optics, Imaging & Information, Biophotonics, Industrial Photonics) do not have CNRS researchers and struggle to provide a continuous duty in view of the large teaching charges. Some subteams have less than two ETPR which is close to the critical mass.

The support for network and computer facilities is carried out by four agents dealing also with other IOGS units, but only 1 agent was clearly identified to support LCF. This appears to be undersized, but the assessment of the highly interpenetrated IOGS and LCF services is considered to be beyond the mission given to this committee.

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

The IOGS owns the premises and takes care of the maintenance and the network security (involving a CNRS IT agent affiliated at IOGS).

Gender parity, high on the agenda of all authorities, is taken very seriously by the management of the LCF with many original actions specified elsewhere. Although the numbers are especially unfavourable among CNRS employees (6%), the global percentage of 26% female staff is satisfactory. No less than 38% of the PhD students are female, and clearly the LCF policy fosters equal opportunities between women and men.

The LCF is exposed to real dangers related to equipment such as strong lasers and X-ray facilities, and safety measures are taken very seriously, with mandatory training for newcomers.

A carbon footprint of the unit's activity in 2022 has been taken, showing that more than 75% of Carbon emission stems from heating, electricity consumption and overall purchase for the experiments. A discussion is going on how to reduce the CO2 footprint and a chart is in preparation. The installation of photovoltaic cells is under contemplation, as can be expected from a unit specialized in optics.

Weaknesses and risks linked to the context

The protection of data and network security does not seem to be a direct concern, and is considered to be a responsibility entirely delegated to IOGS services. The backup and protection of data and its overall management is not specified and centralized and often carried out by the teams on their own servers.

The general services of the IOGS dealing with the security of the entire building are understaffed, and potential security threats such as the misfunctioning of emergency exits of the LCF are not dealt with.

EVALUATION AREA 2: ATTRACTIVENESS

Assessment on the attractiveness of the unit

The main attractivity of LCF stems from its unique combination of blue sky research in many different subjects in optics, its advanced technological skills, the training through research and the research for innovation. This formula is highly successful because it attracts many students, it feeds many scientific collaborations, is attractive for fund-raising, gives rise to major scientific and technological breakthroughs, and supports many different kinds of collaborations with industry. The large national and international recognition of the attractivity is testified by prestigious nominations and prizes, including the award of the Nobel Prize that has radiated the scientific excellence of the entire LCF across the world. In addition, a long list of organized events and international invitations exists. Last but not least 87 PhD defenses have taken place, and roughly 70% of these students have graduated first outside IOGS and have thus been attracted.

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 success in competitive European calls for tender is more than impressive: three Quantera contracts (a leading European network of Research Funding Organisations including Israel, Norway, Turkey and UK, supporting the development of Quantum Technologies), three ERC grants, seven grants from Horizon Europe or Horizon 2020 programs, and one grant from ESA. Often, many scientific and/or industrial partners in Europe are involved.

The LCF is involved in three large consortia, MICADO (Multi-AO Imaging Camera for Deep Observations concerning the future ELT of ESO), SPHERE+ (upgrade of the SPHERE instrument, which is the High Contrast Data Centre of the existing Very Large Telescope) and a consortium concerning the UV optics of the telescope aboard the Solar Orbiter. The team on Quantum Gases is part of an international consortium on mathematics and physics of Anderson localization, supported by the Simons Foundation.

On the national level LCF is highly successful in getting grants. It has benefitted from 47 ANR grants involving all eight teams and participates in four PEPR programs (three by Quantique, one by Origins). Locally, 21 Labex (mostly PALM) and three Equipex supports were obtained.

The LCF was supported by the CNRS-Prématuration program, several small grants have been obtained involving industrial projects as well as an association of enterprises (Renault, Chanel, SGD Pharma, Saint-Gobain) created by the new team on Industrial Photonics. Finally, around ten DIM regional projects have been funded.

The technical support is highly customized to the needs of the LCF, unique in its kind and highly qualified. Its services are frequently solicited outside the LCF. Scientific and technical staff members are actively involved in several platforms: the in-house CeMOX facility on UV/X multilayer coatings is operated with SOLEIL, the electron beam lithography system "Nanobeam" installed at Thales RT that produces high quality electronic writings with resolution of 20 nm on samples as large as 200mm, and a few state-of-the-art facilities in nanotechnology exist at C2N. Technical staff is involved in the scientific activities and have co-authored 47 publications.

Another important strength is the financial support provided by authorities and the unit itself to launch the first projects of new recruitments.

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

The success in European and international competitive calls is largely dominated by the teams "Quantum Gases" and "Quantum Optics".

The administrative unit suffered from a turbulent turn-over and is still precarious. A major risk is the struggle to replace highly specialized technical staff members where in addition one has to compete with the private sector.

The single IT engineer appointed by CNRS is affiliated with LCF but assigned to the IOGS DSI desk for "efficiency reasons".

In view of the large activity, the large network containing 50 students, 20 postdocs, more than 60 permanent staff members, his full-time appointment to LCF would be highly justified as also requested by many staff members.

Despite the huge scientific attractivity, the LCF struggles to recruit postdocs and CNRS junior staff, undoubtedly due to the high competition in the private sector (including the startups created at LCF).

The large competences of the 6 desks of technical support stay too much in the shadow of the scientific success and deserve more outreach. For instance, hardly any explicit IT highlights were put forward in the self-assessment document, only during the oral presentation of IT services, that was scheduled on demand of the committee. One exception is the software Simphotonics FMM that is now managed and developed the nanophotnic group, and that was put in the highlights.

EVALUATION AREA 3: SCIENTIFIC PRODUCTION

Assessment on the scientific production of the unit

During the 6-year term, the LCF has produced 381 publications in peer-reviewed journals, with a large fraction published in top journals such as Nature and related high impact journals (13), Optica (4), PRL (27), PRX (9), and Science (2). With 31 EQTR (Equivalent Time Research with faculty staff counted as 1/2 because of teaching duties, and not counting 2 technical staff members that have partial scientific activity) this comes down to 2 publications/yr/EQRT which is more or less equal to the national average. In view of the many time-consuming and high-risk experiments and the strong engagement of many staff members in valorisation and administration of various kinds, this number must be considered as highly satisfactory. LCF members have delivered 200 invited conferences (5 on average per permanent staff member, but this number fluctuates among members) and organized twenty scientific events. Several breakthroughs of different nature may be mentionned such as the observation of Bogoliubov modes in Bose-Einstein superfluids, the demonstration of quantum simulation using a platform of 200 Rydberg atoms interacting by dipole-dipole coupling, diverse new ultrafast laser sources, the demonstration of a LED pumped femto-second laser, the development of a radiative thermal nano-diode, the modeling of photonic resonances with quasi-normal modes (a highly cited paper), the study of laser-increased temperature rise in nano-fibers, plasmonic sub-micrometer sources of heat for chemical structuration of biosensors, the on-sky demonstration of optimal control based on wavefront sensor measurements on the William Herschel 4-m telescope, the experimental demonstration of new periodic multilayer systems with record reflective performance at wavelengths between 40 nm and 65 nm.

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

No non-active staff has been identified, and three technical staff members signed 47 publications (12%), the in-house platform CeMOX produced 30 scientific articles.

Updated versions of all publications have been posted on ArXiv and HAL. UPSaclay provides a mandatory course on ethics in science for PhD students.

Weaknesses and risks linked to the context for the three references above

The three authorities encourage the open access of produced data. As is the case in so many other units in France, this recommendation is widely recognized yet still easier said than done, especially for science conducted with industrial partners. Only the team on Biophotonics reported the upload of data on the open archive at the University of Paris-Saclay as a basis for neural network training and as such highly useful to other people.

With only 43 permanent scientific staff, among which 25 faculty members with teaching load, the objective of LCF to maintain excellence in so many distinct activities, in valorisation, in competitive calls, as well as in national and international steering committees, may not be sustainable.

EVALUATION AREA 4: CONTRIBUTION OF RESEARCH ACTIVITIES TO SOCIETY

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

The LCF stands out as a major interface between fundamental research in optics and innovative applications, not only with commercial objectives but also with the intention to increase the performance of scientific instruments in telescopes, Lidar, X-ray reflectors and coherent tomography. No less than 16 patents were filed and one software package (Simphotonics Matlab toolbox) was registered. One common research laboratory ("Labcom") with the laser company Amplitude has been active since 2014, one other is in preparation with the company PASQAL, a startup on quantum technologies with Rydberg atoms that was created in 2019 at LCF with now more than 230 employees and that has moved to Massy. Another startup DAMAE Medical has emerged from the team Biophysics that develops new "hand-held" instruments for skin imaging.
The LCF has a very healthy activity related to outreach, vulgarisation, and promotion of physics at high schools, a good exemple is the video serie "manip". Of course one should mention the publicity around the award of the Nobel Prize, the laureat being well known for his pedagogical explanations of quantum physics and his engagement to defend the importance of science for climate and society.

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

The social-economic activities of the LCF are exemplary and have become one of its "raisons d'être". The unit is active during les "fêtes de la science", has organized "speed meetings" gathering high school students and female scientists. YouTube videos have been created about quantum entanglement – awarded the Nobel Prize 2022 – and about various other activities at LCF such as quantum memories, fibre optics, X-ray scattering at SOLEIL and lasers for planetary research. The many activities "Femmes et Science" contribute a lot to make physics more popular among women.

Weaknesses and risks linked to the context for the three references above

No communication officer exists at LCF that coordinates these activities and that could put them in a global strategy of the LCF.

It may be desirable to make the technical services more visible in outreach and not to focus only on scientific breakthroughs.

The production of simulation software is well recognized at LCF but valuing could be improved. Even if codes are deposited on open Archives, good documentation on how to use and how to install is essential for them to be useful to others.

ANALYSIS OF THE UNIT'S TRAJECTORY

For the next term 2026-2030 there is no significant change in scientific strategy foreseen and the main objectives – scientific excellence and proximity to training and innovation – will continue to be displayed. A new director will be appointed and the unit has already proposed an internal candidate who is part the team Quantum Gases.

The teams will not change a lot either, only the team on Nonlinear Optics will be closed, whereas the team on Industrial photonics is very likely to expand with a newly recruited engineer to be assigned. The LCF will have a major challenge to organize and sanctify its administrative desk and to improve its communication with the IOGS desks, supported by a new head of administration that will arrive in January 2025. A joint research laboratory DESIDIX will be created on plasma diagnostics involving the teams of lasers and XUV optics as well as CEA-DAM. Another one will be created with the former startup PASQAL. Four CNRS scientists and two IOGS/UPSaclay faculty staff members will retire. The latter are likely to be replaced via an opening for associate professor at UPSaclay and to be assigned at IOGS, accompanied by a 46.3 promotion to professor level (privileging staff involved in university administration).

RECOMMENDATIONS TO THE UNIT

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

Despite goodwill on both sides, the communication among technical, administrative and network services of IOGS and LCF is not as fluid as it should be. The organisation of regular meetings with active participation of staff members of both IOGS and LCF should help to avoid top-down decisions from IOGS. The arrival of the LCF administrative head and the partial re-localisation of the services at LCF might be a great opportunity to recast and clarify the role of the administrative staff.

UP-Saclay has been created in 2019 and is a tremendous opportunity for LCF. It is obvious that keeping good links with the UP-Saclay at all levels is crucial for the LCF, as its omnipresence in all activities is foreseen to grow in the next term.

The unit management should encourage junior researchers to get their habilitation as soon as possible, if only because the supervision of the many PhD students currently relies a lot on co-supervising.

The visibility and promotion of the technical and technological activities of the general support services could be improved and is currently too much in the shadows of the scientific activity. A demand exists that the general support be supervised by an IT agent (and an obvious candidate is identified). The committee recommends that this proposition gets the attention it deserves.

The presence of a roadmap for newcomers, mostly students, in the form of a booklet or a webpage in (also) English language and regularly updated, is highly recommended.

Only few transverse interactions exist among the quite autonomous groups. The shared pool of students and postdocs as well as the shared general services are an opportunity to increase the corporate LCF feeling. A small support for pizza meetings to students – open to all – may be one suggestion.

Recommendations regarding the Evaluation Area 2: Attractiveness

To be more attractive for recruitments at CNRS, a better synchronisation of some teams to different sections of CoNRS piloted by either CNRS Physique or CNRS Ingénierie may be necessary.

Recommendations regarding Evaluation Area 3: Scientific Production

The unit is exemplary in this respect.

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

The unit is exemplary in this respect.

TEAM-BY-TEAM

Team 1: Quantum Gases

Name of the supervisor: Mr Thomas Bourdel

THEMES OF THE TEAM

In a broad sense, the team is working on quantum simulations using ultracold gases. The team addresses mainly fundamental problems related to many-body physics and strongly correlated systems in the context of quantum optics and out-of-equilibrium dynamics. As the team possesses six experimental platforms with excellent complementarity, they can explore various situations as transport in disordered media and quantum gases in low dimensions. The team is also focusing on the key aspect of pair correlations in the real and reciprocal spaces thanks to a unique platform (e.g. quantum microscopes) and an original method (e.g. microchannel plates for single atom detection).

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous report made the following recommendations: "Le comité recommande de veiller à maintenir suffisamment de personnes (permanents et non permanents) sur les différents projets, en fonction des possibilités de recrutements de doctorants et post-doctorants pour chaque projet. L'équipe devra profiter au maximum des possibilités de financement apportées par le Flagship pour certains des projets en mettant l'accent sur leur aspect "quantum technologies."

With the recruitment of one CRCN, the team has maintained a satisfactory level of staff working on each experimental platform. Even if the number of permanent researchers is still modest to maintain six platforms, the team has successfully attracted numerous talented PhD students. The team has benefitted from the Flagship calls, while remaining on its historical research topics that are not always in the main stream of the Flagship; for instance, no research on qubits exists in the team. The level of funding is excellent.

WORKFORCE OF THE TEAM: IN PHYSICAL PERSONS AT 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	2
Maîtres de conférences et assimilés	1
Directeurs de recherche et assimilés	3
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	16
Sous-total personnels non permanents en activité	**19**
Total personnels	**27**

EVALUATION

Overall assessment of the team

The publication rate of the team is 1.4 publications/year/ETPR. This is a good number in view of the complexity of the experimental setups. The papers are published in excellent peer-review journals (Phys. Rev. Lett., Nature Physics) and have a strong impact as is revealed by the large number of citations. Most of the team members are strongly involved in teaching, outreach and administrative duties. The team is at an outstanding level in research and valorisation. A large fraction of their scientific results is at the upper word-class level.

Strengths and possibilities linked to the context

The team is composed of 27 members, including eight permanent researchers. As such, the team has a critical mass for the development of ambitious projects in a very competitive environment.

The team is built up around a collaborative approach, sharing human, financial and technical resources in the various projects. In addition, regular meetings among the team members help the cross-fertilisation.

The team has six experimental setups with excellent complementarity, as they operate on different species and isotopes (fermions and bosons). Each of these species has its own specificities that the team has demonstrated to exploit. In this regard, the Helium platform is rather unique.

During the evaluation period, the team has attracted eighteen PhD students, where most of them come from the best schools and masters in France. It reflects the strong attractivity of the team. The total number of PhD students is excellent, and allows for a good overlap from one PhD generation to the next: about1.5 students/setup. The graduated PhD students have good employment opportunities (startup in QT, Post-doc, …)

In addition to the excellent research activities, most of the permanent staff members are strongly involved in teaching, outreach and administrative duties such as CNRS committee, co-direction of the LCF, direction of the studies of IOGS, organisation of various conferences and schools, and production of large audience videos to quote only those. Most of the team members are invited to top conferences showing that their activities are well recognized and established in their scientific community and beyond.

Some of the team members have prestigious distinctions such as Alexandre Joannidès prize from the French Academy of Sciences 2023 and the Physics Nobel prize 2022.

During the last term the team has been awarded numerous competitive grants for a total of ~3.3 M€. These large funding resources has allowed the team to maintain their experimental platforms at the state-of-art, and to initiate new platforms complementary to existing ones (e.g. the ones involving Strontium and Helium 3).

Even if it is still a minor source of funding, it should be noted that fundings coming from innovation have grown (0 k€ in 2018 and 44 k€ in 2023). This is an impressive result for a team that defines itself as working on fundamental problems.

Weaknesses and risks linked to the context

Two post-docs are currently working in the team. This can be considered as few when comparing to their major international competitors, the number (6) of platforms, and the comfortable funding situation of the team.

Analysis of the team's trajectory

There are no significant changes in research topics foreseen by the team in the near future. This decision makes sense as the team has been successful and its topics continue to be state-of-the-art worldwide. More generally, most of the existing platforms will pursue their studies though in more depth, such as the dynamics induced by three-body interaction, correlation and entanglement phenomena in quantum atom optics, and the critical regime at the Anderson transition. The generalisation of optical shaping devices will provide extra tools to generate or to enhance the effects under study. The setup of the Strontium experiment has been finalized, and should produce its first scientific results on out-of-equilibrium dynamics soon. Thanks to the recent recompositing of the team's permanent members, the Helium activity will be extended to the fermionic isotope. As Helium offers a unique perspective, this choice seems to be highly relevant.

At the organization level, the team plans to reinforce its internal collaboration and to pursue its recent collaboration with the team on quantum optics. Here again, the strategy is appropriate.

RECOMMENDATIONS TO THE TEAM

The team is at an outstanding level with a fruitful collegial organization. The trajectory is ambitious but realistic. The only recommendation is to follow the planned trajectory.

Team 2: Quantum Optics

Name of the supervisor: Mr Philippe Grangier, Ms Rosa Tualle-Brouri and Mr Antoine Browaeys

THEMES OF THE TEAM

The team is working on quantum technologies using photons and atoms and explores a large variety of topics ranging from fundamental questions to applications, often in direct collaboration with the private sector. The team is dominantly experimental, studying ultracold atoms and photonic systems. Ultracold atoms are used in tweezer arrays for quantum simulation using Rydberg interaction. Photonics systems are used to generate non-Gaussian states and to develop cryptography with continuous variables. On the theoretical side, the team has a cross-disciplinary activity on the epistemology of quantum mechanics.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

"L'abandon du projet "non-linéarités géantes" est regrettable. Il ne devrait être que provisoire, au vu de son intérêt propre et des investissements importants qu'il a occasionnés"

The project on « non-linéarités géantes » has been definitively closed as it required large human and founding investment. Instead, the team has reoriented its activities towards CVQKD (Continuous-Variable Quantum Key Distribution), which has been an excellent move.

"Un renforcement de l'équipe serait le bienvenu, compte-tenu des départs récents et de la diversité des recherches effectuées dans le groupe"

The number of permanent staff members has remained steady, but the number of non-permanent staff members has substantially increased from 10 to 15.

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	3
Chargés de recherche et assimilés	1
Personnels d'appui à la recherche	0
Sous-total personnels permanents en activité	**5**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	3
Doctorants	12
Sous-total personnels non permanents en activité	**15**
Total personnels	**20**

EVALUATION

Overall assessment of the team

The team has a publication rate of 2.3 publication/years/ETPR. This is an excellent performance in view of the complexity of the experimental platforms. Some publications are of outstanding level (4 Nature, 2 Nat. Phys. and 7 Phys.Rev. Lett.). The team members are regularly invited into international conferences (~100 over the period). During the period, the funding resource of the team was around 6.8 M€. These metrics show the world-class level of the team.

Strengths and possibilities linked to the context

The team has made pioneer works on neutral atom arrays which is now one of the hottest and most competitive topics in ultracold atoms thanks for it potential applications in quantum computing. This activity has led to the creation of the startup company Pasqal. This is an outstanding result of the team.

During the period of evaluation, the team has broadened its experimental direction by setting up a new platform using dysprosium atoms. The progress was fast and the quality of the first results are promising. The team has worked on cooperative light-atom interaction in dense media. The topic is not as visible as the one of the neutral atoms arrays but the results are also excellent.

On the photonics side, the team has successfully generated photonic cat states. This is a noteworthy result considering the small number of researchers involved in the project. The foundation of quantum mechanics activities of the team remains of very high quality with a clear cross-disciplinary visibility.

During the period of evaluation, the team has attracted thirteen PhD students coming from the best school and master in France and in Europe. With four experimental setups, one counts on average two PhD students per setups, allowing an excellent overlap between succeeding PhD generations.

During the evaluation period, the funding resource of the team has been around 6.8 M€. A large fraction of the resources come from international calls, in particular two members have been awarded ERC grants. More modest resources come from innovation (~80 k€) and may grow since the team created the startup Pasqal and collaborates with companies such as Thales, Nokia and Exail.

The recognition of the team is excellent at the national and international level, bringing large visibility to the team and to the LCF.

Weaknesses and risks linked to the context

The funding of the team is excellent but, for understandable reasons, not evenly distributed among the various activities of the team. As a result, funding lacked at certain periods of time and some activities had to be slowed down.

Analysis of the team's trajectory

In 2025, the founding activity of the team will be closed because of the retirement of its PI. The team will be reorganized among the two remaining activities. The team is considering to recruit a new junior and a team with a new research activity.

Concerning the atom activity of the team, the strategy consists in pursuing the development of the neutral atom array platform towards quantum simulation of many-body problems. Here, the creation of the Labcom with its former startup Pasqal will be a strong asset. In addition, the team is planning to develop its activities further on cooperativity effects in light-matter interaction either by using a dense atomic medium in a trap, in line with the past activities, or by using a sub-wavelength lattice. The latter will be implemented on the new Dysprosium setup. Atom array platforms are now used worldwide, so the competition might become harder. The situation is well understood and well anticipated by the team in its strategic plans.

The long-term objective of the activity on the generation of non-classical states will be to create more complex quantum states for quantum processing. To achieve this ambitious goal, the team plans to improve the current setup, and to include spectral filtering and longer storage time to encode qubits in the continuous variable regime.

The trajectory of the team is ambitious but is necessary because one faces a growing international competition and new challenges require an increasing complexity of the experimental setup. The large know-how built up in this team gives good confidence that these projects can be realized.

RECOMMENDATIONS TO THE TEAM

The team performs at an outstanding level and its strategies are comprehensive, ambitious, and realistic. Our recommendation is to pursue the large efforts to realize them.

Team 3: Lasers

Name of the supervisor: Mr Patrick Georges

THEMES OF THE TEAM

The Laser team develops new light sources by exploiting and exploring various innovative concepts and original geometries in laser physics and nonlinear optics. This involves a wide range of media (crystals, glasses, semiconductors, bulk materials, fibres, gases) and the use of innovative architectures (coherent combining, luminescent concentrators, multi-pass cells) to tailor the different properties of laser sources in terms of temporal regimes (from single-frequency CW to few-cycle pulses), spectral ranges (from the XUV to the mid-infrared) and energies (up to Joules).

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The first recommendation included to continue the development of lasers in partnership with industry, while maintaining a more fundamental research activity.

The work presented during the last term, has been motivated by the needs of applications rather than to increase fundamental knowledge.

The other recommendation was to respond to European calls by submitting proposals.

An ITN proposal was submitted (unfortunately unsuccessful) and the Laser team is a partner of the H2020 project "THRILL".

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	3
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	0
Personnels d'appui non permanents	0
Post-doctorants	1
Doctorants	8
Sous-total personnels non permanents en activité	**9**
Total personnels	**15**

EVALUATION

Overall assessment of the team

The team's common denominator is the development of powerful coherent light sources that are diverse with strong links with many companies and a privileged partnership with Amplitude. The concepts and achievements are excellent with a sustained level of publications, numerous contracts, collaborations and recruitments of PhD students and post-docs. With three CNRS staff members and three faculty staff members, 58 publications have been produced (~2.1/year/ETPR). The study of ultrafast laser sources covers several areas, from multi-pass cells to sources for nonlinear microscopy and optogenetics. LED-pumped luminescent concentrators are novel and an important topic to be developed in the future. Finally, coherent combining is an interesting approach to increase the optical power accessible from semiconductor devices beyond their individual technical limits while maintaining the spectral and spatial quality of the source. The work presented is a snapshot of the topics within the group which covers many different areas and that are in constant evolution.

Strengths and possibilities linked to the context

The team studies a wide range of topics and has leading expertise in numerous different developments of light sources. It is dynamic in responding to or partnering in funding calls. The current development of the ultrafast sources and LED-pumped luminescent concentrators implies that this know-how can be harnessed to a wide range of applications, with publications in high-impact optics journals. This expertise also enables the team to establish or to take part in new projects, with sufficient funding to pursue these directions. An important strength of the team is its strong and close links with industry with, for example, the existence of a common lab in-house with Amplitude since 2014.

Weaknesses and risks linked to the context

There has been a lack of recent recruitment, which could put future projects at risk. However, the team has been proactive in identifying and in proposing candidates for CNRS positions.

Although the team has strong international collaborations and recognized profile, most funding comes from national calls.

Analysis of the team's trajectory

The team has an activity that is well-balanced and an appropriate evolution, with a mixture of current and new research directions. New areas to be developed include, for example, high energy nanosecond lasers and hybrid fibre-bulk sources.

RECOMMENDATIONS TO THE TEAM

The team would strongly benefit from the recruitment of a permanent researcher to foster collaborations in new research areas. This is particularly important, considering the team central role in laser physics and applications at the national level and the current average age of the team members. The committee encourages the team to continue its search for potential candidates.

The international collaboration profile of the team could be further enhanced by responding to European calls for tender.

Team 4: Nanophotonics

Name of the supervisor: Mr Christophe Sauvan/ Mr Jean-Jacques Greffet / Mr Philippe Ben-Abdallah

THEMES OF THE TEAM

The team focuses on light-matter interactions at the scale "below the optical wavelength" that is, when matter structure has length scales smaller than the wavelength of the light, used to interact. The team is active on subjects ranging from fundamental concepts to applications and from theory to experiment. The team is subdivided in subteams tackling different topics: 1) Nano-optics and devices: focus on computational nanophotonics on resonant non-Hermitian systems, studies on devices: photonic crystals and industrial partnership on passive metasurfaces; 2) Thermoplasmonics: focus on near-field radiative transfer and its applications as well as thermal/energy management assisted by near-field physics; 3) Plasmonic and quantum nanophotonics: focus on theoretical models dealing with the emission of light from nanoobjects: metals, metasurfaces, single emitters.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The recommendations were:

L'équipe devra pérenniser l'excellence et le rayonnement de son activité de recherche associant de façon très équilibrée des recherches purement théoriques et des travaux théoriques étroitement liés aux expériences.

Maintenir l'échange fructueux entre recherches exploratoires et finalisées.

Capitaliser sur le rayonnement international de l'équipe pour renforcer sa participation dans des projets européens, notamment dans le cadre du H2020 avec la photonique comme « key technology ».

The team has continued to work on the interplay of fundamental theory and more applied theory to support experiments. The international recognition is evident with highly cited papers and international use of source codes. Many local and national grants have been obtained, and industrial/European fundings have been obtained through two (renewed) IPCEI projects with the STMicroelectronics company.

WORKFORCE OF THE TEAM: IN PHYSICAL PERSONS AT 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	2
Maîtres de conférences et assimilés	1
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	2
Personnels d'appui à la recherche	0.5
Sous-total personnels permanents en activité	**6.5**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	1
Post-doctorants	4
Doctorants	3
Sous-total personnels non permanents en activité	**8**
Total personnels	**14.5**

EVALUATION

Overall assessment of the team

The team has an excellent publication record with 3.7 publications per year per ETPR. One software engineer is working half-time in this team. The published papers are of high quality. The work on the theory of quasi-normal modes and the related review article written with colleagues from the LP2N in Talence is a highly cited paper. With the help of this groundbreaking work the team is now able to work with dielectric resonant systems and reconstruct the scattered field with many applications. In thermoplasmonics, the team has proposed to deposit heat from infrared emission on a subwavelength scale by using evanescent photons (carrying heat) in the near field of a nanotip. The team has even gone one important step further and proposed a scheme to control this heat deposition with multiple tips. More generally the team is working towards heat transfer at atomic scales. Finally, it is actively investigating the control of spontaneous light emission using nanoscale objects like metasurfaces and single photon emitters. This work is done in close partnership with industry both through Cifre PhD students (5 during the period) and has also led to patents and a startup creation.

Strengths and possibilities linked to the context

The team is able to model, simulate and predict nanophotonics systems photonic nanostructures and devices; that gives it a very broad and stable ground to perform advanced research.

The team attracts many industry partnerships leading to Cifre PhD, and the outcome of its research is generating patents and a project on a startup is initiated.

The theoretical and numerical activity has led to the development of the software package SimPhotonics-FMM published under an open-access BSD3 license.

Weaknesses and risks linked to the context

The team is split into three subteams with about one to two ETPR per subteam which is below the critical mass.

The team has no team leader that speaks up for the entire team.

The retirement as emeritus of two prominent members raises the question if the subteams should be maintained.

The lack of recruitment is cruelly showing up in the nanophotonics team. It will be difficult to continue tackling so many aspects in the future.

The development of SimPhotonics is highly recognized by the community and is said to be open-source. However, the package is actually built on top of commercial Matlab software, which is not open-source but required to run the codes. The committee has taken notice of a pdf document comprised of 4 pages with some examples, but without step-by-step guide. The lack of a refined documentation (for instance how to install, run and troubleshoot the code) must be considered as a weakness to use and share this software.

Analysis of the team's trajectory

The team has a balanced project that relies on the development of theory and codes. Both are used to model devices and this study is accomplished in close collaboration with industry whenever possible. The future of the team should be secured if it manages to recruit replacements for the future departures.

RECOMMENDATIONS TO THE TEAM

The team is encouraged to reconsider the splitting into subcritical subteams. The initial reason for this split undoubtedly existed but is no longer visible today and has gone lost in the numerous broad and inter-related activities of research.

For a better access to its open-source software, more effort should be done to improve the documentation and maybe to facilitate the portability towards real open software packages.

Team 5: Nonlinear Photonics

Name of the supervisor: Mr Philippe Delaye

THEMES OF THE TEAM

The research activity of the Nonlinear Photonics team has focused on silica nanofibers with nonlinear optical properties. These nanofibers have been successfully incorporated into devices and have demonstrated their ability to form photon pair sources and Raman sensors. These are the two main current activities of the team, which has a unique and strong expertise in the modelling, design and fabrication of nanofibers on a home-made pulling platform. The maturity of this platform has also enabled the team to investigate new mechanisms for potential applications and to consider new methods to characterize the nanofibers.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The number of topics was considered too large for the size of the team. The committee was concerned about the feasibility of these topics, given the small number of permanent staff members and recommended continuing to refocus activities on a small number of topics.

The team has followed the committee's recommendations as activities other than the two main ones mentioned above are being transferred to Bordeaux.

The committee considered that following the significant reduction in the size of the team, participation in the Lasers and Quantum Optics teams could be an interesting avenue to explore on a more sustained basis, given the proximity of certain research themes between these two teams and the Nonlinear Photonics team. The committee recommended that the team continues its efforts to recruit a new permanent member of staff, an experienced researcher on contract or explore the possibilities of forging closer links with other research teams in the laboratory.

The Nonlinear Photonics team followed the recommendations. Today, the Nonlinear Photonics team has only two permanent staff, one of them will join the Quantum Optics team with the photon pair sources activity and the other permanent staff will join the Laser team with the Raman sensors activity. They will continue to share and develop the nanofiber pulling platform.

WORKFORCE OF THE TEAM: IN PHYSICAL PERSONS AT 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maîtres de conférences et assimilés	1
Directeurs de recherche et assimilés	2
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	0
Sous-total personnels permanents en activité	**3**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	1
Sous-total personnels non permanents en activité	**1**
Total personnels	**5**

EVALUATION

Overall assessment of the team

There were three funded projects during the evaluation period: 1 ANR PRCE in collaboration with Thales Research and Technology (2016-2020), 1 DIM SIRTEQ (2019-2021) and 1 Labex 'PALM' (2021-2023). The team receives a recurrent funding of 7.5 k€/year from the LCF. There is a still informal collaboration with LSCE for the development of pollutant sensors. Since 2018, the team has published 11 articles in peer-reviewed journals of high quality. With a research staff of ETPR=2.5 this implies 0.7 publication per year and per ETPR which is quite low. The team's work has been reported in 26 presentations (oral or poster) at international conferences and 6 at national conferences. The work of the team addressed the observation of pairs of photons with a signal-to-noise ratio defining the state of the art of fibre sources in pulsed mode but also in continuous mode. It also concerned the optimization and reliability study of wavelength converters by stimulated Raman scattering in the evanescent field of nanofibers immersed in different liquids. Six PhD students have defended their theses and the team has supervised 12 Master internships.

Strengths and possibilities linked to the context

The team has a wide range of equipment that allows to carry out its activities with a relatively low budget and has focused on a smaller number of topics, as was recommended by the previous HCERES committee.

The staff members of the team have several additional responsibilities in different international institutions, i.e. the European Optical Society, the International Commission of Optics and the FRQNT of Quebec. The faculty member has also several educational responsibilities as she is in charge of the university recruitment at the IOGS school and in charge of a Master.

The team tries to respect gender equality in its recruitment of students. The faculty member of the team has been the referent for gender equality for the IOGS students since 2019, and has been working to promote gender equality in scientific careers by organizing several actions at LCF and IOGS. She has benefitted from financial support.

Weaknesses and risks linked to the context

Following the refocusing of research activities, the number of publications declined, but the results already achieved will help the team to return to its usual publication level.

The Nonlinear Photonics team will have further reduced its staff with the retirement of one of the two CNRS researchers in mid-2025.

Analysis of the team's trajectory

The LCF has decided to close this team as of 2025 because of the strong reduction of the permanent members staff and the difficulties encountered in the recruitment of new PhD students. One permanent member will join the Quantum Optics team with the photon pair sources activity, and the other member decided to join the Laser team with the Raman sensors activity.

RECOMMENDATIONS TO THE TEAM

The committee supports the closure of the team and wishes the two members good luck in their forthcoming collaborations inside new teams that undoubtedly offer new opportunities.

Team 6: Biophotonics

Name of the supervisor: Ms Nathalie Westbrook

THEMES OF THE TEAM

The team is focused on the development of optical instrumentation applied to biology and medicine, with a focus on biomedical imaging tools based on optical-coherence tomography, in vivo functional imaging based on speckle contrast, nano-plasmonics, biomechanics using optical tweezers and fluorescence microscopy.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous report recommended an emphasis on more fundamental aspects. These have been taken into account. There is still clearly a well-recognised applied aspect but the role of fundamental research increased.

A recommendation was made regarding the rather isolated nature of the each of the activities. There is somewhat more cohesion between the members than before but there is still room for improvement for the development of joint projects between subteams.

The final recommendation was: refocusing on themes that may cut across the three sub-teams. There is clearly a potential for this and the recommendation is being considered but has not yet reached maturity (see second recommendation) due to the difficulties encountered in the recruitment of permanent researchers.

WORKFORCE OF THE TEAM: IN PHYSICAL PERSONS AT 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	2
Maîtres de conférences et assimilés	2
Directeurs de recherche et assimilés	0
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	0
Sous-total personnels permanents en activité	**4**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	5
Sous-total personnels non permanents en activité	**5**
Total personnels	**9**

EVALUATION

Overall assessment of the team

The team common theme is the development of advanced and varied optical methods and instruments for biophotonic applications and is complemented by strong links with international academic collaborations and with industry through DAMAE Medical and several Cifre contracts. The results are excellent in terms of publications (37 publications for four ETPR) and training (numerous PhD students). A few national grants exist, with also the successful integration of a new group member since 2020 that fills the vacancy left behind by the departure of a CNRS researcher. There are four main research topics. Biomedical Imaging Systems – that has strong links with industry (DAMAE Medical, co-founded by A. Dubois in 2014); In-vivo functional imaging, a theme that settled at LCF in 2020, with a common interest on modelling diffusive tissue with the Biomedical Imaging Systems; Biomechanics with optical tweezers and fluorescence microscopy that includes a micro-rheology project that is carried out jointly by two members of the team; and nano-bioplasmonics activities that studies the micro-structuring of the biochip surface. This last activity is more fundamental, and covers a range of different research profiles. It has developed interactions with the Nanophotonics team of LCF. The first three activities are more applied and pluri-disciplinarily, even including collaborations with hospitals.

Strengths and possibilities linked to the context

The team has long-standing and excellent expertise in instrumentation for biophotonics, with a broad scope of research themes and extensive collaborations, including links with medical experts. The research subjects have a common theme that supports the synergy in the many different activities.

The team has strong links with industry in particular with the startup DAMAE medical.

The publication record, which is excellent, covers both biological, biophotonics and photonic journals that highlight the interdisciplinary nature of the team's activity.

Weaknesses and risks linked to the context

The permanent research members are all established faculty staff resulting in a large teaching commitment, limiting the time to develop new research directions or synergies between team members. The difficulty of recruiting postdocs transfers most of the research effort onto the staff members themselves.

Regarding the recruitment of a CNRS researcher, the team is not well synchronized with the CoNRS sections. Several sections do exist where the team could potentially recruit.

Analysis of the team's trajectory

The future project is based on current successful research with some evolutions towards real biological questions, but no concrete plan exists to foster the interactions between subteams. The team aims to attract a CNRS researcher and discussions are going on with a potential candidate. It could benefit from a real strategy to recruit new researchers.

RECOMMENDATIONS TO THE TEAM

The group would strongly benefit from a recruitment of a permanent CNRS researcher in order to encourage collaborations on new research areas, as well as between the (sub-)team members. There is currently no CNRS researcher in the group despite the high-quality work of the group. Related to this, a strategy to identify the most appropriate CNRS section for the team activities should be developed, though, for example, discussions with other units on biophotonics, or by directly contacting sections of the CoNRS.

Regarding the importance of this research on the international level, European funding opportunities should be considered. This could facilitate postdocs recruitments for relatively long duration that could eventually help to identify candidates for a permanent researcher position.

Team 7: Imaging and Information

Name of the supervisor: Mr François Goudail / Ms Caroline Kulcsár

THEMES OF THE TEAM

The team Imaging and Information focuses on imaging systems combined with information processing. Accounting for the physical properties of the acquisition chain allows to optimize the associated numerical processing. The team works in two domains: 1) In Adaptive Optics, work focuses on modelling and control for adaptive optics. It comprises theoretical and methodological developments with experiments for astronomy and free space optical communications. This activity is supported by several international collaborations.

The team also develops co-design, taking into account planned image processing in the design phase of optical and polarimetric imaging systems. Both theoretical and experimental developments take place, and this topic also leads to transfer of technology to industry.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Recommendations to the team were the following:

One will have to take care of maintaining the current balance between modelling and experimentation, as well as academic and industrial collaborations. It will also be important to maintain an active scientific watch to prepare for the future.

The team has clearly maintained a good balance between its scientific activities. Maintaining an active scientific watch remains a general recommendation for the future.

Strengthening the group in terms of human resources.

One retirement of a senior member in September 2023 was replaced by a new recruitment of a MCF who arrived in November 2023. Nevertheless, the group remains subcritical with five members, all being faculty staff (2 Professors and 3 Assistant-Professors) with heavy teaching loads.

The committee recommends that the team, in addition to its current activities, pays close attention to the emergence of new methods/techniques that could appear on the international scene.

The team is aware of this recommendation, and which will be reconducted by the present committee.

WORKFORCE OF THE TEAM: IN PHYSICAL PERSONS AT 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	2
Maîtres de conférences et assimilés	3
Directeurs de recherche et assimilés	0
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	0
Sous-total personnels permanents en activité	**5**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	2
Doctorants	2
Sous-total personnels non permanents en activité	**4**
Total personnels	**9**

EVALUATION

Overall assessment of the team

The team focuses on the joint design of imaging instruments and information processing, coupled to adaptive optics. In this field the team is recognized as leading. Scientific production of 49 articles corresponds to 3.3 publication/year/ETPR, which is excellent, given that the members are also strongly involved in many IOGS activities. The scientific production is also of high quality, published in well-recognized journals in optics (Opt. Lett., Opt. Express, JOSA…). The computational aspects of the research have led to publications in good journals in computer science and electrical engineering (e.g. IEEE Trans. Image Processing).

Strengths and possibilities linked to the context

The research activities, in adaptive optics and co-conception of imaging systems, are original, solidly developed, and have fostered a strong recognition of the team in France and abroad. This explains the attractiveness of the team, active in conference organizations and involved in many projects, as a partner in some of them, as a PI in others. In particular, the dynamism of the adaptive optics activity is remarkable, with involvement in European projects and consortiums. The strong connections of the co-conception activity with industrial partners (Thales, New Imaging Technologies, I2S) or other research organisms are also to be emphasized. This offers many possibilities to get PhD fellowships (eight PhDs have been successfully defended (only 1 abandon), and currently four PhDs are in preparation, impressive for a team with five permanent members (2 PU, 1 MCF HDR, 2 MCF). The team has hosted 3 long-term visiting Chinese PhD students, as well as five Postdocs.

The research on adaptive optics is presently mostly focused on instrumentation for astronomical telescopes, with also an activity in free-space optical communications. Optical microscopy is another domain, which could greatly benefit from the team's expertise. The co-conception activity has applications in diverse domains such as optical microscopy or polarization imaging, and has given birth to interesting transfers, such as the integration of a co-conception approach into a commercial software, and an ASTRID project with French companies. The present development in division-of-focal-plane sensors could also open new opportunities, in polarized microscopy for example.

Weaknesses and risks linked to the context

The team consists of five permanent faculty staff members with significant teaching load. The activities are entirely piloted by the two professors (industrial and valorisation contracts, research contracts). Team members are highly involved in IOGS activities, with a risk of overload.

The team does not benefit from a full-time research position, which would help maintaining the present high research activity, or from a full-time engineer, which imposes a strong limitation for applied developments. While the total team budget is comfortable, experimental developments are lengthy and costly, and, especially for the adaptive optics activity, the team is strongly dependent on external collaborations, with other teams outside LCF hosting the experimental equipment. As was mentioned in the auto-evaluation report, the involvement of the team in dissemination to the general public is rather low, and could be strengthened, as application topics such as astronomy (adaptive optics), or microscopy (co-conception) are usually attractive for young researchers, and are also positively viewed by the general public, even if such an activity is known to be time consuming.

Analysis of the team's trajectory

The team project is based on its two current activities: Co-design and Adaptive Optics.

The subteam on Co-design will continue to develop the approach it has initiated, by connecting professional optical design software with processing algorithms. Work on polarization imaging system will continue to focus on Division-Of-Focal-Plane (DOFP) sensors. This theme plans several collaborations with research organisms or companies.

In adaptive optics, the proposed projects stay focused on astronomical observations and free-space communications. The team is involved in large collaborations on world-class instruments (GTCAO, SPHERE+, MICADO), and such developments being time consuming, recruitment of at least one research engineer for a permanent position is planned. Free-space communication is a theme that will continue to be studied with foreign partnerships, but a new collaboration has also been initiated with Imagine Optic in 2024.

A common project entitled "Localization microscopy for biological imaging" is presented, linking the two activities of the team, and appears promising. Such a project could open new internal and external collaborations.

These projects are scientifically sound, and built on the strengths of the team.

RECOMMENDATIONS TO THE TEAM

The team produces high-quality work. It has presently no permanent researcher. It would greatly benefit from a permanent CNRS and/or Engineer position, for which a recruitment strategy should be established. It would also greatly help to strengthen other activities of the team, for which lack of human resources is clearly a limitation.

In view of the team's activity, preparations for junior members to get the Habilitation à Diriger les Recherches should be encouraged. It will also be important to incentive the youngest members to get involved in partnership research, not as participant only, but also to take responsibility as principal investigators, both for research projects and for industrial contracts.

The team benefits from strong links with industrial partners or other research organizations (ONERA), which offer numerous opportunities for PhD fundings. It goes without saying that these links should be maintained and that needs fostering every day.

The team is conscious of its main weakness, lack of dissemination to society, and it is clear that the overload of the team is a handicap. This may explain that the portfolio component of the report is only made out of research papers, and no other items exist, such as dissemination actions, or conferences to a general audience.

Team 8: XUV Optics

Name of the supervisor: Mr Franck Delmotte

THEMES OF THE TEAM

The research activities of the XUV Optics team focus on the development of high quality XUV optics (thin-films components, gratings...) for a large number of experiments in different scientific areas (soft X-ray spectroscopy, inertial confinement fusion, astrophysics…), as well as in military projects and space missions. The XUV team is also improving its metrology techniques and applies this expertise to gain a better understanding of the interaction between X-rays and matter.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The recommendations of the former HCERES report were:

The team was encouraged to continue disseminating its scientific and technological knowledge through publications and participation in international conferences.

The cohesion within the team should be maintained.

Maintain the balance between the scientific research and components production.

Attract a greater number of students.

The team has successfully implemented these recommendations in an exemplary manner.

WORKFORCE OF THE TEAM: IN PHYSICAL PERSONS AT 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	1
Maîtres de conférences et assimilés	3
Directeurs de recherche et assimilés	0
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	1
Sous-total personnels permanents en activité	**5**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	4
Sous-total personnels non permanents en activité	**4**
Total personnels	**9**

EVALUATION

Overall assessment of the team

XUV radiation plays a rapidly growing role in both scientific and industrial fields. Both new coherent sources (synchrotrons, free-electron lasers) and new pulsed sources (high harmonic generation) are emerging. Numerous applications in various scientific and technical fields (astrophysics, fusion, photolithography, chemistry…) are in constant demand of new XUV-related technology and expertise. In this context, the XUV team is developing new components and metrology tools for the XUV spectral range. It is also interested in a better understanding of the mechanisms by which XUV radiation interacts with matter (decoherence in the photoionization process, determination of optical constants in thin films). To this end, the XUV team uses and runs the in-house CeMOX platform (with the Soleil synchrotron) which is entirely dedicated to XUV optics, and relies on the expertise of the LCF polishing workshop. The unique environment in which the team operates, combined with its long-standing expertise in the field, gives it an outstanding international recognition. The

team is involved in a number of major international projects. However, most of the collaborative projects are led by the team leader. The team's interest in a new fundamental physics topic (the study of decoherence in the X-ray photoionization process) is valuable and is a sign of its dynamism and its ability to innovate. The number of PhD students has also increased with respect to the previous assessment period, confirming the growing attractiveness of the team. With four faculty staff members and one full-time engineer, the 23 published papers imply 1.3 publications /year /ETPR, which is excellent for a team with large service tasks.

Strengths and possibilities linked to the context

The combination of the CEMOX platform and LCF polishing workshop creates a unique experimental facility for the development of high-quality XUV multilayer coatings used for a wide range of applications in various scientific fields.

The team activities aim to develop an in-depth understanding of the processes involved in the XUV spectral range, which will enhance its expertise in the development of thin films in the future.

The team has gained worldwide recognition and is heavily involved in a number of international projects.

It is committed to long-term partnerships with a wide range of socio-economic stakeholders. It is heavily involved in scientific outreach activities.

Weaknesses and risks linked to the context

The XUV team clearly lacks the human resources to meet national and international demands, not only in terms of thin film production but also in terms of scientific expertise. The team is made up exclusively of faculty staff members, who have large administrative responsibilities. There is no permanent full-time CNRS researcher. This explains the relatively low number of publications.

The team activity is closely linked to the CEMOX platform whose operation depends exclusively on a single engineer and his expertise.

The team's activity depends on the continuation of the expertise of the LCF polishing workshop, although services provided by external companies represent a backup solution. Unfortunately, this makes the future of the team activity uncertain.

Analysis of the team's trajectory

In line with the current activities of the XUV team, the project presented aims to increase the performance of XUV optics and to extend the spectral bandwidth to shorter wavelengths. This is a commitment within the framework of national and international projects of various kinds. The team also intends to extend its activities towards quantum metrology and the study of decoherence and entanglement phenomena. It is clear that the team aims to capitalize on its recognized expertise and wants to take advantage of the current interest in quantum technologies, with a considerable in-house expertise in other teams. However, no strategy is proposed to address the risks related to the CEMOX platform and the LCF polishing workshop presented in the previous paragraph.

RECOMMENDATIONS TO THE TEAM

The team is encouraged to increase the attractiveness of the team activity for young scientists with the hope of recruiting a new CNRS staff member in the team.

The extension of the team activity to topics related to quantum physics is a good strategy to achieve this, as it opens up the activity to other communities that produce many students.

The team is encouraged to formulate a strategy in order to reduce the dependency of its activity on the LCF polishing workshop and to guarantee the sustainability of a proper functioning of the CEMOX platform by sharing the required expertise among the team members.

Team 9: Industrial Photonics

Name of the supervisor: Mr Yvan Sortais

THEMES OF THE TEAM

The Industrial Photonics team was created in January 2019. Its research activities are based on several collaborations with French companies. The team activities are focused on three main aspects: 1) the design of free-form optics and the corresponding metrology technique; 2) the increase of angular resolution in BRDF measurements for the characterization of rough surfaces and 3) the improvement of illumination and detection tools to limit errors in recognition processes based on artificial intelligence.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

This is a new team that did not exist during the period evaluated by the former HCERES report.

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	0
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	0
Sous-total personnels permanents en activité	**1**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	3
Sous-total personnels non permanents en activité	**3**
Total personnels	**4**

EVALUATION

Overall assessment of the team

The team started in 2019 with only one permanent member. He was joined later by three PhD students and one post-doc. The team strength lies in the fact that it tackles problems faced by industrial compagnies that do not fit within the usual research activities carried out in optics laboratories.
The team has published four papers, three of them are related to conferences. This is in agreement with the team research activities and corresponds to 1.6 publication/year/ETPR. This represents a good publication rate considering the range of the covered subjects.

Strengths and possibilities linked to the context

The Industrial Photonics team benefits from the expertise of the various teams at LCF and from technical resources, including some in other optics laboratories (CNAM, Laboratoire Hubert Curien). The objective is to establish sustainable collaborations with companies. As a result, it has become remarkably attractive to industry in a wide range of applied research fields. This type of collaborations naturally provides a return on investment, not only for the team but also for the laboratory.

Weaknesses and risks linked to the context

The team's activity is based on various collaborations with companies with quite diverse interests. The committee was impressed by the results of the ongoing projects. However, the team activity is managed by only one permanent staff member. It implies that the know-how acquired in ongoing projects is likely to be lost when the non-permanent members (students and postdocs) have left.

This is likely to hinder the sustainability of industrial collaborations, which are currently of a short-term nature. Moreover, a part of the team activity relies on the availability of members of other teams it collaborates with, which might represent a serious issue in the future.

Analysis of the team's trajectory

The team proposes to focus its activity exclusively on the study of free-form optics, following the three aspects presented above, namely free-form design, manufacturing processes and characterization techniques. The team will continue to be at the centre of collaborations involving both industrial partners and other research teams and institutes. A position is open at Paris-Saclay to recruit an engineer.

RECOMMENDATIONS TO THE TEAM

The team is encouraged to pursue with the proposed strategy which is to focus its activities on free-form optics. Such activities are already responding to significant demands from industrial partners.

More fundamental developments are required to provide the tools to design and control free-form optics. The committee encourages the team to publish this work in peer-reviewed journals since it is of interest to a wide community.

CONDUCT OF THE INTERVIEWS

Dates

Start: 9 December 2024, at 8:45 a.m.

End: 11 December 2024, at 5:00 p.m.

Interview conducted: on-site

INTERVIEW SCHEDULE

Lundi 9 décembre 2024

08h15 - 08h45 : Accueil : thé, café, viennoiseries
08h45 - 09h00 : Présentation du comité et du programme
09h00 - 10h00 : Présentation du directeur
10h00 - 10h30 : Questions du comité et échange
30' (thé, café, viennoiseries)
11h00 - 12h30 : Présentations scientifiques :
Gaz Quantiques (25'+10')
Optique XUV (15'+10')
Imagerie & Informations (15'+10')
15' Huis clos
12h45 - 14h30 : Pause déjeuner, Buffet-posters
14h30 - 15h45 : Présentations scientifiques :
Nanophotonique (20'+10)
Photonique Non Linéaire (10'+10)
Photonique Industrielle (10'+10')
15' Huis clos du comité ou pause
16h00 - 18h15 : Visites de 4 expériences (2h15)

Mardi 10 décembre 2024

09h00 - 10h30 : Présentations scientifiques
Optique Quantique (15'+10')
Lasers (20'+10')
Biophotonique (15'+10')
30' Huis clos du comité et pause
11h00 -11h50 : Échange comité – Administration (env. 15') ;
Échange comité – IT (IT/BIATSS/CDD/CDI) (env. 35')
11h50 - 12h35 : Échange comité – Doctorants et Postdocs (45')
10' Huis clos du comité
12h45 - 14h00 : Pause déjeuner
14h00 - 14h45 : Échange comité – C/EC (45')
15' Huis clos du comité ou pause
15h00 - 15h30 : Échange comité – responsables d'équipes (30')
15' Huis clos du comité ou pause
15h45 - 18h30 : Visites des expériences (2h35)

Mercredi 11 décembre 2024

09h00 - 09h30 : Présentation (orale) des activités des Services Généraux Scientifiques et Techniques (20')
09h30 - 11h00 : Visites des Services Généraux Scientifiques et Techniques
11h00 - 12h00 : Échange comité – Direction & future direction
12h00 - 13h00 : Échange comité – Direction & future direction (suite)
13h00 - 14h45 : Pause déjeuner et Huis clos du comité (discussion pour le rapport)

PARTICULAR POINT TO BE MENTIONED

The committee regrets the absence of a representative of the DR4 of the CNRS during the meeting with authorities. Several CNRS staff members have not received calls for systematic medical visits during the last years.

GENERAL OBSERVATIONS OF THE SUPERVISORS

INSTITUT d'OPTIQUE GRADUATE SCHOOL
ParisTech

Monsieur Olivier BONNEAU
Directeur par intérim du Département d'évaluation de la recherche
HCERES
2 rue Albert Einstein
75013 PARIS

Palaiseau, le 28 mars 2025

Objet : Rapport d'évaluation **DER-PUR260024883 - LCF - Laboratoire Charles Fabry**.
Réf. : IO-DG-IL-L-2025-24

Cher Collègue,

Les tutelles du Laboratoire Charles Fabry vous remercient ainsi que tous les membres du comité HCERES pour leur travail d'évaluation.

Elles n'ont aucune observation de portée générale à formuler sur le rapport d'évaluation transmis.

Je vous prie d'agréer, Cher Collègue, l'expression de mes cordiales salutations.

Rémi CARMINATI
Directeur Général
de l'Institut d'Optique Graduate School

2, Avenue Augustin Fresnel
91127 Palaiseau Cedex - France
Tél. : 33(0)1 64 53 31 00
www.institutoptique.fr

The Hcéres' evaluation reports are available online:
www.hceres.fr

Evaluation of Universities and Schools
Evaluation of research units
Evaluation of the academic formations
Evaluation of the national research organisms
Evaluation and International accreditation

Evaluation · Research · Higher Education
Hcéres

19 rue Poissonnière
75002 Paris, France
+33 1 89 97 44 00