



LKB - Laboratoire Kastler Brossel

Rapport Hcéres

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REPORT ON THE RESEARCH UNIT:
Kastler Brossel Laboratory
LKB

UNDER THE SUPERVISION OF THE
FOLLOWING INSTITUTIONS AND
RESEARCH BODIES:

École Normale Supérieure

Sorbonne Université

Collège de France

Centre National de la Recherche Scientifique -
CNRS

ÉVALUATION CAMPAIGN 2017-2018
GROUP D



In the name of Hcéres¹ :

Michel Cosnard, President

In the name of the expert committee² :

Vahid Sandoghdar, Chairman of the
committee

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

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

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

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

UNIT PRESENTATION

| | |
|--------------------------------------|-----------------------------|
| Unit name: | Laboratoire Kastler-Brossel |
| Unit acronym: | LKB |
| Requested label: | UMR |
| Application type: | Renewal |
| Current number: | UMR 8552 |
| Head of the unit (2017-2018): | Mr Antoine HEIDMANN |
| Project leader (2019-2023): | Mr Antoine HEIDMANN |
| Number of teams: | 12 |

COMMITTEE MEMBERS

| | |
|---|---|
| Chair: | Mr Vahid SANDOGHDAR, Max Planck Institute, Germany |
| Experts: | Mr Jean-Claude BERNARD, CNRS (supporting personnel) Mr Benoît BOULANGER, Université Grenoble Alpes (representative of CNU) Mr Florent CALVO, CNRS (representative of CoNRS) Mr Aristide DOGARIU, CREOL University of Central Florida, USA Mr Thierry GIAMARCHI, Université de Genève, Suisse Mr Ekkehard PEIK, PTB Braunschweig, Germany Ms Christine SILBERHORN, Universität Paderborn, Germany Mr Guglielmo TINO, Università degli Studi di Firenze, Italy Mr Pierre-Etienne WOLF, CNRS |
| HCERES scientific officer: | Mr Christian BORDAS |
| Representative of supervising institutions and bodies: | Mr Niels KELLER, CNRS Mr Yves LASZLO, Ecole Normale Supérieure Mr Bertrand MEYER, Sorbonne Université Mr Jean-Marie TARASCON, Collège de France |

INTRODUCTION

HISTORY AND GEOGRAPHICAL LOCATION OF THE UNIT

Laboratoire Kastler-Brossel (LKB) is located on three different sites: 24 rue Lhomond (ENS, the original historical site), Campus de Jussieu, 4 place Jussieu (Sorbonne Université) and 11 Place Marcelin Berthelot (Collège de France). The laboratory was named in 1994 from “Laboratoire de Spectroscopie hertzienne de l’ENS” to Laboratoire Kastler-Brossel after Alfred KASTLER and Jean BROSSEL, who pioneered a great deal of the modern physics on light-matter interaction after the Second World War with contributions that led to the Nobel prize for Alfred KASTLER in 1966. The advent of lasers was successfully utilized at the lab in the 1970s and 80s, leading to the seminal work of Claude COHEN-TANNOUDJI, and his younger colleagues in cooling and trapping of neutral atoms. Among other exciting works at LKB during this time, Serge HAROCHE led efforts that gave birth to the field of Cavity Quantum Electrodynamics. These activities resulted in two Nobel prizes in 1997 and 2012 for Claude COHEN-TANNOUDJI and Serge HAROCHE, respectively.

LKB has experienced a substantial growth in the past two decades with many new scientists and research directions. This expansion has also led to new administrative and governance changes as well as new geographic locations and quite a bit of construction work.

MANAGEMENT TEAM

Mr Antoine HEIDMANN (director)
Mr Pierre-Jean NACHER (deputy director)

HCERES NOMENCLATURE

ST: Science and technology
ST2: Physics
ST2_1: Nuclear physics and particles
ST2_2: Molecular physics, plasma, optics

SCIENTIFIC DOMAIN

Research at LKB covers many areas of quantum optics and atomic, molecular and optical physics. The traditional strength of the lab is in atomic and laser spectroscopy with particular emphasis in fundamental questions of light-matter interaction, quantum states of light and precision spectroscopy. One of the important developments of the past three decades concerns cooling and trapping of neutral atoms as well as the rich field of quantum gases and liquids, establishing a bridge between atomic physics and condensed matter physics. Another landmark of LKB has been in studying photons and atoms at their fundamental levels with seminal contributions to the field of Cavity Quantum Electrodynamics and quantum optics. Today, these concepts and techniques continue to play a central role in the research topics of LKB. However, the lab has also embarked on different research fields, involving more complex quantum states of light, optomechanics, imaging in biological and complex media, Casimir effects, ion traps, large-scale collaborations in metrology, nonlinear optics and nanophotonics.

UNIT WORKFORCE

| Unit workforce | Number 30/06/2017 | Number 01/01/2019 |
|---|----------------------|----------------------|
| Permanent staff | | |
| Full professors and similar positions | 14 | 14 |
| Assistant professors and similar positions | 15 | 15 |
| Full time research directors (Directeurs de recherche) and similar positions | 10 | 10 |
| Full time research associates (Chargés de recherche) and similar positions | 9 | 10 |
| Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.") | 0 | 0 |
| High school teachers | 0 | 0 |
| Supporting personnel (ITAs, BIATSSs and others, notably of EPICs) | 20 | 20 |
| TOTAL permanent staff | 68 | 69 |
| Non-permanent staff | | |
| Non-permanent professors and associate professors, including emeritus | 4 | |
| Non-permanent full time scientists, including emeritus, post-docs | 39 | |
| Non-permanent supporting personnel | 4 | |
| PhD Students | 60 | |
| TOTAL non-permanent staff | 107 | |
| TOTAL unit | 175 | |

GLOBAL ASSESSMENT OF THE UNIT

The "Laboratoire Kastler-Brossel" is an internationally leading research unit in the area of low-energy quantum physics. The traditional emphasis of the lab has been in atomic physics and light-matter interaction, which has resulted in three Nobel Prizes over a period of about fifty years. During this time, the unit has continually evolved in terms of scientific, administrative and geographic locations to maintain its position at the forefront of modern research. Starting with its original anchor at the "École Normale Supérieure", it is now co-supervised by the Sorbonne University and "Collège de France" at three different geographic sites of close vicinity in Paris.

Current topics of research at LKB encompass fundamental questions in quantum physics, quantum optics, quantum gases, physics of complex systems, and metrology. The laboratory continues to operate at the highest international level, confirmed by the quality and quantity of scientific publications as well as the unusually large number of successful research grants, especially from the European Research Council (ERC).

Since its last evaluation in 2012, the unit has taken several important strategic measures to ensure a sustainable scientific program. Particularly noteworthy is the establishment of a new research axis concerning “Frontiers and Applications” to connect its core competence with other fields of science and technology such as medical imaging, technology transfer, and large-scale international collaborations.

LKB is well positioned to contribute to the rapidly growing area of quantum technologies emphasized by the European flagship program, which fosters an experimental and theoretical mastery of complex quantum systems. To ensure LKB’s success in an internationally very competitive scene, it is important that the supervising institutions adapt their administrative and funding schemes as well as personnel policies to increase the efficiency in achieving the scientific and technological advances.

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