Introduction to

Institut d’Optique

Graduate School

www.institutoptique.fr

May 2019

Pierre BALADI
Head of International Relations
2017: celebrated 100 years of research and education in optics and photonics

A century of expansion
- 1917: creation of Institut d’Optique, in Paris
- 1965: moving from downtown Paris to Orsay campus
- 2003: new campus in Rhône-Alpes
- 2006: moving from Orsay to current location in Palaiseau
- 2012: new campus in Aquitaine
- 2017: commitment to be a member of Université Paris-Saclay

A rich history
- Charles FABRY
  1st Director General (1917-1945)
- Alfred KASTLER
  President of the Board (1960s)
- Alain ASPECT
  Augustin Fresnel Chair Professor & Scientific Advisor

2019:
- Saint Etienne
- Paris-Saclay
- Bordeaux
13% of French R&D
2 Nobel Prize Winners
10 Fields Medallists
8 Schools
- 45 Master’s programmes
- 300 Master’s tracks (15% in English)
65,000 students
- 9,000 Master’s students, 38% international
- 4,600 PhD students, 42% international
20 doctoral schools – 1,300 PhDs/year
9,000 faculty & academic staff
146 ERC grants for 161 ERC projects
(1st in France, 3rd in Europe)
12,000 publications/year

Projected ranking 2017

US News Best Global Universities ranking 2018
- 30th Worldwide
- 1st in European Union
- 1st in France
Maths: 1st Worldwide, Physics: 5th Worldwide
An International Research University

- 13 outstanding scientific facilities - Equipex
- 11 Laboratories of excellence - Labex
- 23 Strategic Research Initiatives
- More than 400 active international partnerships
- 45 CNRS International Associated Laboratories - LIA – more than 25% of French LIAs

- International Master’s Scholarships - 160 Incoming full Master’s scholarships / yr
- Over 350 full PhD grants / year with additional UPSaclay funding for cotuteltes with international universities
- Jean d'Alembert fellowship programme for junior and senior foreign scientists: 6-12 month stays - 10 laureates per call – Researchers working in any field & from any country
- Paris-Saclay Chairs of excellence: 5 laureates (450k€ / 3years)
Nationwide presence

Paris Saclay
Physics & Engineering of light

St Etienne
The imaging chain, lighting & energy

Bordeaux
Nanophotonics & digital optics

Graduate education
Research
Innovation
A graduate school with >1000 people

**Graduate education**
- Master of Science in Engineering degree (500)
- Master degrees (50)
- PhD (150)
- Co-operative education programme (‘co-op’) with companies: CFA SupOptique
- Continuing Education

**Research**
- 3 research centers with international reputation
  - LCF: Laboratoire Charles Fabry (150)
  - LP2N : Photonics, Digital Data and Nanosciences (50)
  - LHC : Laboratoire Hubert Curien (170) – common with UJM St Etienne

**Innovation**
- 210 people (headcount)
- 37 startup companies in integrated partnership
- 2 innovation centres at the ‘503 Centre’, Institut d’Optique’s own innovation centre: 10000m² + 1500m²
A graduate school of international level

Graduate education
- One of the widest ranges of courses in photonic and optical engineering
- Strong links between Master-Engineering degree-PhD: 35% of graduates undertake a PhD worldwide (4th/168 engineering schools in France)

Research
- 1 scientific paper and 2 communications per day
- 37 Highly Cited Papers (web of science)
- Numerous international prizes

Knowledge dissemination
- Today: home of Société Française d’Optique (National Optical Society)
- European Optical Society was created at Institut d’Optique (1993 merger)
Innovation

- 3 MIT Technology Review Best World Innovators Under 35
- 2 start-up companies created per year since 2008


« Its strategic position as a leading engineering school specializing in optics and photonics, makes it unique in France and among the very best in the world. »
Research areas

- Lasers
- Nonlinear Materials
- X & UV Optics
- Cold Atoms
- Quantum Optics
- Biophotonics
- Nanophotonics
- Instrumentation
- Image Processing
- Visual Rendering
- Safety
- Components & Systems for Photonics
- Virtual & Augmented Reality
- Digital Images

PARIS-SACLAY
Laboratoire Charles Fabry LCF (150 people)

SAINT ETIENNE
Laboratoire Hubert Curien (170 people)

BORDEAUX
Laboratoire Photonique Numérique et Nanosciences LP2N (50 people)
Innovative Engineers

4 x more patent holders than the average French school of engineering

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Accomplishments</th>
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</thead>
<tbody>
<tr>
<td>Pierre ANGÉNIEUX</td>
<td>1929</td>
<td>Inventor of the automatic zoom lens</td>
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<td></td>
<td></td>
<td>French optics accompanied the first men on the moon</td>
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<tr>
<td>Bernard MAITENAZ</td>
<td>1947</td>
<td>Inventor of the progressive lens (Varilux)</td>
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<td></td>
<td></td>
<td>Chairman of the Board &amp; CEO Essilor</td>
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<tr>
<td>Sébastien BIGO</td>
<td>1992</td>
<td>Record transmission on a single optical fiber</td>
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<td></td>
<td></td>
<td>(70 Tbit/s over 10 000 km)</td>
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<tr>
<td>MIT Technology Review Best World Innovators Under 35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gabriel CHARLET</td>
<td>1999</td>
<td>Optical communication platforms at 40 &amp; 100 Gigabit/s,</td>
</tr>
<tr>
<td>Thibaut MERCEY</td>
<td>2000</td>
<td>Fast optical detection of molecules</td>
</tr>
<tr>
<td>Anaïs BARUT</td>
<td>2014</td>
<td>Non invasive detection of skin carcinoma</td>
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The School of Engineering with 4 Oscars

Henri CHRETIEN
for his "hypergonar" optical system

Pierre ANGENIEUX (1929):
2 Oscars (1964 & 1989)
for his motion picture zooms lenses

Jacques DEBIZE (1967)
Technical Oscar 2009

Paris-Saclay
Saint-Étienne
Bordeaux
Innovation Entrepreneur Track (FIE)

- 70 projects created (since 2006)
- 14 new companies
- 16 national & international awards
- 2 industry awards

EFFI Flex 2013 product of the year in industrial vision

STEREOLABS

2014 3D Technology Awards
software of the year

- 48 other awards
Some companies created by FIE

- **EffiLux**: LED Lighting for the industry
- **AventLidar Technology**: LiDAR for wind plant optimisation
- **epsiline**: Wind speed measurement
- **nodea medical**: Breast cancer diagnosis tool
- **enovasense**: Thickness control of industrial coatings
- **STEREO LABS**: High quality 3D information
- **M**: 3D laser animations
- **Net Vitesse**: Logistic solutions for industry
- **DAMAE MEDICAL**: Non invasive skin diagnostic

Locations:
- Paris-Saclay
- Saint-Étienne
- Bordeaux
<table>
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<tr>
<th>1st year = Bachelor final</th>
<th>2nd year = Master 1st</th>
<th>3rd year = Master 2nd</th>
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<tbody>
<tr>
<td>General inter-disciplinary education</td>
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<tr>
<td>General scientific education</td>
<td>General scientific education</td>
<td>Wide range of openings and specialisations</td>
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<tr>
<td><strong>Photonics</strong></td>
<td><strong>Paris Saclay</strong> : Light-Matter Interactions, Signal and Image Sciences, Nanosciences, Extreme (X and UV) Optics</td>
<td><strong>Bordeaux</strong> : Photonics and Digital Sciences, Virtual Reality, Cognitive Sciences, Physics and Modelling</td>
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<td></td>
<td><strong>St Etienne</strong> : Photonics for Imaging, Lighting, Energy</td>
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<tr>
<td>1 month internship</td>
<td>3 month internship</td>
<td>4-6 month internship</td>
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Every subjects related to photonics and innovation:
- Instrumentation, components
- Sources, Lighting
- Optical design
- Image processing
- Telecommunication
- Electro-optical systems
- Measurements

Training
- On catalogue
- On demand, in French or in English
- Short or long programs
Education Lab in photonics

Very wide spectrum from embedded electronics to quantum optics

Photometry
Lasers
Fibers
Polarization

Infrared
Electronics
Optical systems
Quantum optics

Paris-Saclay
Saint-Étienne
Bordeaux
Education Lab in photonics

150 experiments including 80 different subjects
International perspectives

Looking back on a century of History...

Foreign students since the first intake (1919 for the MScEng programme)

1st cohort from 1919: among 16 students,
1 from Poland
1 from Japan
1 from the USA
International perspectives

Worldwide partnerships in the 21st century

Double-degrees / MSc abroad offer
- KTH Royal Institute of Technology, Stockholm
- EPFL - Ecole Polytechnique Fédérale de Lausanne
- F-S-U Jena - Friedrich-Schiller-Universität Jena
- DTU - Danmarks Tekniske Universitet - Technical University of Denmark (Kongens Lyngby)
- NTNU - Norges teknisk-naturvitenskapelige universitet - Norwegian University of Science and Technology (Trondheim)
- TU Delft - Delft University of Technology
- Politechnika Warszawska - Warsaw University of Technology
- University of Cambridge
- Cranfield University
- Imperial College (Londres)
- University of Southampton

Erasmus exchanges
- Université de Liège
- HAWK (University of Applied Sciences and Arts) Hochschule Hildesheim/Holzminden/Goettingen
- Universität Stuttgart
- Universidad de Murcia
- Politechnika Warszawska (Wydział Mechatroniki)
- KTH Royal Institute of Technology
- Universit of Eastern Finland, Joensuu
- NTNU - Norwegian University of Science and Technology
- Koç University
- Delft Technical University

Framework agreements
- University of New South Wales (Sydney)
- Instituto de Fisica de São Carlos da Universidade de São Paulo
- Escola Politecnica da Universidade de São Paulo (EP-USP)
- Escola de Engenharia de São Carlos - Universidade de São Paulo (EESC-USP)
- East China Normal University, Shanghai
- Tsinghua University, Beijing
- Huazhong University of Science & Technology, Wuhan
- Faculty of Physics at Technion-Israel Institute of Technology
- School of Engineering Science, Osaka University
- Université d'Etat de Moscou, Bauman
- Université d'Etat de Novossibirsk
- Tomsk Polytechnic University
- ITMO University, Saint Petersburg

Paris-Saclay

Saint-Étienne

Bordeaux
International perspectives

Outgoing international mobilities for MScEng

Bachelor final year
- **ATHENS Programme week**: 1-week course in March in European partner universities within ATHENS network
- **Internship (>4 weeks)**: can be carried out abroad, especially in summer schools (ITMO)

Master 1st year
- **Internship (>3 months)**: can be carried out abroad, in university lab or company

Master 2nd year
- First **semester** can be done as **exchange student** in a partner university
- **Final internship (>4 months)**: can be carried out abroad, in university lab or company
- Whole year can be replaced by **MSc in a foreign university (DD)**
Incoming international students in MScEng

Semester or year as exchange student (non-degree)
- From September 2017 onwards, **one semester offered in English**
  - First semester of M1 level courses

Degree-seeking student (2 or 3 years)
- Either admitted for M1-M2 years: possibility of international track thanks to the first semester in English
  - 1 Semester in English, with language courses of French for foreigners (=adaptation semester), then other semesters in French
- Or admission in Bachelor final year for 3 years (B3-M1-M2), but in French first (and then some courses in English)
International perspectives

Incoming international students / other mobilities

Research internships
- In Institut d’Optique’s labs
- Usually several months, typically for thesis (BSc or MSc thesis)

Advanced master in Embedded Lighting Systems
- Admission after a Master degree or Bachelor and several years of professional experience
- Specific field: embedded lighting systems in the automobile industry
- Can be part of continuing education

PhD programme
- After a Master degree, for 3+ years, in one of our labs
Photonics

Science and Technology of light
Thanks for your attention!

A graduate in action
0-G experiments in parabolic flights

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