Introduction to

Institut d’Optique
Graduate School

www.institutoptique.fr

2021

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
- **2020**: constituant 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

2021:
Saint Etienne
Paris-Saclay
Bordeaux
➢ 13% of French R&D
➢ 2 Nobel Prize
➢ 10 Fields Medallists
➢ 8 Schools
  - 45 Master’s programmes
  - 300 Master’s tracks (15% in English)
➢ 48,000 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
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 cotutelles 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

The imaging chain, lighting & energy
### 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

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**Paris-Saclay**  **Saint-Étienne**  **Bordeaux**
Institut d'Optique

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)
Institut d'Optique

A graduate school of international level

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

BORDEAUX
Laboratoire Photonique Numérique et Nanosciences
LP2N
(50 people)

PARIS-SACLAY
Laboratoire Charles Fabry LCF
(150 people)

SAINT ETIENNE
Laboratoire Hubert Curien –
with UJM (170 people)

Paris-Saclay

Saint-Étienne

Bordeaux

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

Institut d'Optique Graduate School
ParisTech
<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Achievements</th>
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<tbody>
<tr>
<td>Pierre ANGÉNIEUX</td>
<td>1929</td>
<td>Inventor of the automatic zoom lens</td>
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<td></td>
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<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 (70 Tbit/s over 10 000 km)</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>
</tr>
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Some companies created by Innovation and entrepreneur track students

**LED Lighting for the industry**
- **Effilux**
- **epsiline**
- **blue**
- **magnalucis**

**Wind speed measurement**
- **nodea medical**

**Air quality analysis**
- **enovasense**

**LED Lighting for the Arts & Decoration**

**LiDAR for wind plant optimisation**
- **AventLidar Technology**

**High quality 3D information**
- **STEREO LABS**
- **Minuit UNE**

**3D laser animations**

**Thickness control of industrial coatings**

**Logistic solutions for industry**
- **NetVitesse**

**Spectrometers for medicine**
- **ARCHIMEDE TECHNOLOGY**

**Non invasive skin diagnostic**
- **DAMAE MEDICAL**

**Breast cancer diagnosis tool**
- **nodea medical**

**Paris-Saclay** **Saint-Étienne** **Bordeaux**
Education at Institut d'Optique

Years of Higher Education

1. Bachelor

2. Master Degree

Diplôme d’Ingénieur de l’Institut d'Optique
Master of Science in Engineering

3. Master Degrees

4. Doctorat (PhD)

Doctorate (PhD) in Physics
Prepared at:

5. Continuing Education

Advanced Master ELS

6. Paris-Saclay

7. Saint-Étienne

8. Bordeaux
# Course Structure

**MScEng – Diplôme d’Ingénieur**

<table>
<thead>
<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>
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<td>Wide range of openings and specialisations</td>
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<tr>
<td>Photonics</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>
</tr>
<tr>
<td><strong>St Etienne</strong>: Photonics for Imaging, Lighting, Energy</td>
<td>(1 month internship)</td>
<td>3 month internship</td>
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<td></td>
<td>4-6 month internship</td>
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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
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
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 (London)
- University of Southampton
- Université Laval (Québec)
- University of Arizona, College of Optical Sciences (Tucson, Arizona)
- University of Rochester, Institute of Optics

Erasmus exchanges
- Université de Liège
- HAWK (University of Applied Sciences and Arts) Hochschule Hildesheim/Holzminden/Göttingen
- Universität Stuttgart
- Universidad de Murcia
- Politechnika Warszawska (Wydzial Mechatroniki)
- KTH Royal Institute of Technology
- Universit à degli studi di Modena
- Aalto University, Helsinki

Framework/exchange agreements
- University of New South Wales (Sydney)
- Instituto de Física 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
- Beihang University, School of Instrumentation and Optoelectronic engineering, Beijing
- 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, Beihang...)

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)**
International perspectives

Incoming international students in MScEng

Semester or year as exchange student (non-degree)
- M1 (and some M2) level courses available in English

Degree-seeking student (2 or 3 years)
- Either admitted for M1-M2 years: possibility of international admission thanks to a wide course offer in English
  - Many courses taught in English for the M1 & M2 years, with language courses of French for foreigners (=adaptation semester)
- Or admission in Bachelor final year for 3 years (B3-M1-M2), but B3 year is taught in French (and then part of the courses in English in M1 & M2)
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
Thanks for your attention!

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