The European research landscape in optics and photonics

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Achievements

• Creation of a database
• **Academic research laboratories** and institutions related to **optics and photonics**
• 27 EU member states plus Israel, Norway, Switzerland and Turkey
• Connection with Industry and common use of the information through Dynamo database (TNO)
Method

- Informations collected
  - Name of the laboratory
  - Contact info (address, and phone number)
  - Email
  - Website
  - Head of the institution
  - Description of the research areas
- Common database with Industry
- Accessible to all on www.opera2015.org
Data collection

**Sources**
- Governmental sources
- National optical societies directories or other type of equivalent information
- Optics and photonics conferences lists, such as SPIE, OSA, EOS
- Internal databases

**Verification of the collected information**
- Verification by each partner of the data concerning national labs
Examples of sources

– University Worldwide internet site http://univ.cc
– University and engineering schools associations websites: http://www.amue.fr/Universites; http://www.cge.asso.fr/
– Paris region – Opticsvalley’s internal database
Classification of Research areas
6 main thematics divided into 65 sub thematics

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Ranking of research areas

- Main research areas
  - Lasers and their applications
  - Spectroscopy and Measurement systems
  - Nanophotonics and Quantum optics
  - Biophotonics

![Bar chart showing the ranking of research areas with percentages for each category.]
Repartition of labs by country

About 700 research laboratories registered
Geographical repartition

- 1 to 9 laboratories: 39%
- 10 to 19 laboratories: 16%
- 20 to 50 laboratories: 35%
- More than 80 laboratories: 10%

- 10 laboratories and more: 12 countries
- More than 80 laboratories: 3 countries
- Less than 10 laboratories: 11 countries

Countries with 20 laboratories and more:
- France
- Germany
- United Kingdom
- Italy
- Spain
- Greece
- Portugal
- United Kingdom
- Norway
- Sweden
- Finland
- Ireland
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- Ireland

Specialization of countries

« Coefficient of specialization » in Optics-Photonics (CSOP)

- Group 1: more than 50 million inhabitants
- Group 2: between 10 and 50 million inhabitants
- Group 3: less than 10 million inhabitants

CSOP = Ratio number of labs/population
Specialisation of countries
Group 1 - 3 main countries

- **France**
  - 30% to 40% : Nanophotonics, Lasers, Non linear optics and Optical measurement and sensors
  - 25% : Optical components and devices and Spectroscopy
  - 20% : Biophotonics, Light-matter interaction, Optical instrumentation and Optical communications

- **Germany**
  - 30% to 40% : Lasers and Quantum optics
  - 25% : Spectroscopy, Non linear optics and Laser applications
  - 20% : Biophotonics, Optical measurement and sensors, Light matter interaction and Nanophotonics

- **United Kingdom**
  - 30% to 40% : Optical components and devices
  - 25% : Lasers, Biophotonics, Spectroscopy, Quantum optics, Optical measurement systems, Nanophotonics, Theoretical optics
Specialisation of countries
Group 2 - 3 main countries

- Analysis of the laboratories distribution in this group might not be relevant in case of small numbers

- **Belgium**
  - 30%: Active optical devices, Nonlinear optics, Optical sources, and Quantum optics

- **Netherlands**
  - 40%: Signal and image processing

- **Poland**
  - 30% to 40%: Theoretical optics, Spectroscopy, Light-matter interaction and Optical measurements
  - 20% to 25%: Lasers, Non-linear optics, Biophotonics, Quantum optics, Photo-induced process and Laser applications
Specialisation of countries
Group 3 - 3 main countries

- Ireland
  - 30% to 40%: Optical components and devices and Lasers
- Lithuania
  - 60% to 70%: Photonic crystals and in Linear optics
- Slovenia
  - Mainly applicative
  - 35%: Optical measurement and sensors

Analysis of the laboratories distribution in this group might not be relevant in case of small numbers
Comparison with industry (Data from WP3)

- Classification of countries in 2 groups
  - Group A: number of companies superior to 100
  - Group B: number of companies inferior to 100

- Group A
  - Number of laboratories and companies highly correlated ($R^2 = 0.9$ [1])

- Group B
  - Number of laboratories and companies markedly correlated ($R^2 = 0.7$ [1])
  - Belgium, Poland and Slovenia not included because of an important bias in the results (red dots)

[1] $R^2$ is the square of $R$, the correlation coefficient, calculated by linear regression.
Conclusions (1)

- The OPERA^2015 allowed us to build a comprehensive database of academic research laboratories in Optics-Photonics at European level
  - About 700 research units identified and registered

- The analysis of research topics shows the strengths of European research in O/P
  - Lasers and their applications
  - Spectroscopy and Measurement systems
  - Nanophotonics and Quantum optics
  - Biophotonics
Conclusions (2)

• These first results should be completed with more accurate data, ie. number of researchers in each lab, number of publications etc…

• At this first level of analysis, a correlation between the number of labs and companies in each country has been highlighted

• The collected data is accessible for all on the OPERA2015 Web site