

ESONN'2006

European School on Nanosciences & Nanotechnologies

August 27th - September 16th 2006
Grenoble, France



ORGANIZED BY:
Université Joseph Fourier (UJF)
Institut National Polytechnique de Grenoble (INPG)

CO-ORGANIZED BY:
CNRS
CEA

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Institut National Polytechnique de Grenoble (INPG)
- CO-ORGANIZED BY:** Centre National de la Recherche Scientifique (CNRS)
Commissariat à l'Energie Atomique (CEA)
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✓ SCOPE

ESONN 2006 is the third edition of ESONN.

This 3 weeks course is aimed at providing training for graduate students, postdoctoral and junior/senior scientists from European universities and laboratories in the field of NANOSCIENCES and NANOTECHNOLOGIES in Physics, Chemistry or Biology.

The academic and practical courses will cover the elaboration, functioning and characterization of nano-objects.

The program is structured to highlight the fundamental and technological advances in Nanoelectronics and at the interface between Physics, Chemistry and Biology. The two sessions will be run in parallel but they will share common lectures and practicals, as interdisciplinarity is a clear objective of this school.

- The first session took place from 22 August to 10 September, 2004.

- The second session was organized from 21 August to 9 September, 2005

**The program emphasizes the role of laboratory courses.
Half of the program is devoted to practical works.**

Practicals will be held in clean-room facilities at the Inter-university Center for MicroElectronics (CIME) and in Grenoble Research Laboratories.

▪ Applicants

- ▶ Students enrolled in a university doctoral program.
- ▶ Postdoctoral and junior/senior scientists from academic or industrial laboratories

Applications through European networks of excellence are encouraged.

▪ Application & Registration fees

- ▶ The application forms are available on the web site (www.esonn@inpg.fr).
- ▶ **The registration fees are: 1500 Euros for students from academic laboratories**

2000 Euros for participants from private companies

- The fees include the **attendance to the lectures, seminars and practicals**, the **participation to the social program**, the **housing on a single-room occupancy basis**, the **breakfasts and lunches except during the week-ends**. The dinners are NOT included.
- Thanks to the E.U. support, eligible students can obtain the reimbursement of half the fees. A limited number of travel fellowships will also be available.
- As ESONN 2006 is E.U. Marie Curie conference, **applications from nationals of E.U. member states and associated states will have the priority.**
- **Women are encouraged to participate.** Free child care will be proposed during the 3-week session (day-time during lectures and practicals).

✓ PROGRAM

▪ Lectures

Courses will cover the fundamentals of selected fields that were chosen as being important aspects of the Nanosciences and Nanotechnologies in Physics, Chemistry or Biology. The lecturers are given below.

▶▶ LECTURES FOR SESSION A – 22 x 1H45

- | | |
|---------------------------|--------------------------------------|
| ▪ Mesoscopic transport | Markus Büttiker, Geneva, Switzerland |
| ▪ Single-electron effects | Jan Martinek, Karlsruhe, Germany |
| ▪ Molecular electronics | Marcelo Goffman, Saclay, France |
| ▪ Spintronics | Chris Marrows, Leeds, UK |
| ▪ Physics of devices | Enrico Sangiorgi, Bologna, Italy |
| ▪ Qbits implementation | Elisabetta Paladino, Catania, Italy |
| ▪ Nano and Quantum Optics | Oliver Benson, Berlin, Germany |

▶▶ LECTURES FOR SESSION B – 22 x 1H45

- | | |
|--|---|
| ▪ Surface and molecule physico-chemistry | Alain Brisson, Bordeaux, France |
| ▪ Advanced biophysics for designing micro-systems | Ruud Hovius and Jean-Manuel Segura
Lausanne, Switzerland |
| ▪ Mechanics of molecules and biological structures | Thomas Duke, Cambridge, UK |
| ▪ Immunochemistry and biosensors | Daniele Altschuh, Strasbourg, France |
| ▪ Microfluidics for Lab-on-chips | Patrick Tabeling, Paris, France |
| ▪ Biological applications of microelectrodes | Christian Amatore, Paris, France |

▶▶ COMMON LECTURES – 12 x 1H45

- | | |
|-----------------------------------|-------------------------------------|
| ▪ Technologies of nanofabrication | Giancarlo Faini, Marcoussis, France |
| ▪ Near-field microscopies | Hans Hug, Basel, Switzerland |
| ▪ Neuro - electronics | Peter Fromherz, Munich, Germany |
| ▪ Soft Nanomaterials | Ian Hamley, Reading, UK |

✓ PROGRAM

▪ **Practicals**

Half of the formation is devoted to practicals, which will be held in clean-room facilities at the Inter-university Center for MicroElectronics (CIME) and in Grenoble Research Laboratories.

Practicals in clean-rooms facilities are devoted to the use of the basic tools for micro-fabrication and characterization of micro-objects (micro-circuits, micro-systems). The technologies, which are more specific to the nano-fabrication (e-beam lithography, innovative soft lithographies...), will be addressed through the laboratories work.

Practicals in laboratories are proposed by researchers on their current research and are thus at the leading edge of the international research.

■ **I. PRACTICALS IN CLEAN-ROOM FACILITIES AT CIME (16H)**

▶ **SESSION A:**

- “Micro electro mechanical systems (MEMS)”: modeling and characterization of a pressure gauge

OR

- “MOSFET”: Submicron MOSFET modeling and characterization of MOSFET transistors

▶ **SESSION B:**

“Bio-Chips”: fonctionnalization and characterization of DNA-based bio-chips on Si wafers

■ **II. NEAR-FIELD MICROSCOPIES (8H)**

Practical work on Scanning Probe Microscopies
(at CIME or in a research laboratory)

- Scanning Tunneling Microscopy (STM)
- Atomic Force Microscopy (AFM)

■ III. LABORATORIES PRACTICALS

Practicals have to be chosen within the following list.

Students can choose both session A and session B practicals whatever session they apply to.

□ SESSION A PRACTICALS:

- **A01: Multiscale analysis of semiconductor nanocrystals**
Dimitri Aldakov, Frédéric Chandezon, DRMC/UMR 5819 SPrAM (CEA-CNRS-UJF)/LEMOH, CEA-Grenoble.
- **A02: Electron diffraction and scanning tunnelling experiments on Si surfaces**
Jorg Zegenhagen and Isabelle Joumard, ESRF.
- **A04: E-Beam Lithography and Focus Ion Beam (FIB) techniques for mirco and nanofabrication**
Thierry Fournier, Centre de Recherches sur les Très Basses Températures, CNRS, Cécile Naud, Lepes - CNRS.
- **A05: Electrical characterization of semiconductor nanostructures using ultra high vacuum AFM techniques**
Michael Gordon, LTM-CNRS.
- **A06: Electrical characterization and transport properties in ultrathin-film SOI devices**
Mickael Cassé, LSCPD/D2NT/LETI-CEA.
- **A07: Magnetoresistive Effects in Magnetic Heterostructures**
Laurent Ranno, LLN-CNRS.
- **A08: Low frequency noise measurements as a powerful tool to characterise defects in a MOS transistors**
Marco Pala, IMEP-CNRS-INPG-UJF.
- **A09: Transport through Molecular Junctions : Carbon Nanotubes and Molecules trapped in nano-gaps by electromigration**
Vincent Bouchiat, CRTBT-CNRS and Franck Balestro, LLN-CNRS.
- **A10: Nanometric magnetic cluster growth from gas-aggregation**
Robert Morel and Ariel Brenac, DRFMC/SP2M-CEA-Grenoble.
- **A11: Optimization of NanoImprint Lithography on large surfaces**
M. Zelsmann and C. Gourdon, LTM-CNRS.
- **A12: Shot noise in mesoscopic diffusive conductors**
François Lefloch, DRFMC/SPSMS-CEA.
- **A13: Near fiel studies of model organic and molecular materials**
Benjamin Grévin, SPRAM/CEA-CNRS-UJF and Michel Brun, LETI/DIHS/LMNO-CEA.
- **A14: Synthesis of fluorescent semiconductor nanocrystals and Imaging of semiconductor nanocrystals by high resolution transmission electron microscopy**
Frédéric Chandezon and Peter Reiss, SPRAM-CEA-UJF-CNRS.

- **A16: Elaboration and organisation of nanostructures using diblock copolymer thin films**
Karim Aissou, LTM-CNRS.
- **A17: Local deformation and mechanical properties by nanoindentation**
Marc Verdier and Bruno Gilles, LTPCM-INPG-CNRS.
- **A18: Structural defects and magnetic domain imaging**
Marc Verdier and Bruno Gilles, LTPCM-INPG-CNRS.
- **A19: Force measurement with a micro mechanical oscillator based on tuning fork**
Guillaume Jourdan, Mário Rodrigues, Florence Marchi, LEPES-CNRS and ESRF.
- **A20: Quantum dynamics of molecular nanomagnets**
Wolfgang Wernsdorfer, LLN-CNRS.
- **A21: Carbon Nanotube synthesis and optical characterization by Roman spectroscopy**
Anne-Marie Bonnot and E. Bustarret, LEPES-CNRS.
- **A22: X-ray scattering from films and superlattices**
Eric Dooryhée, ESRF.
- **A23: Silicon nanocrystal-based nanodevices fabricated by Atomic Force Microscopy nano-manipulation**
Sebastien Decossas, LTM-CNRS.
- **A24: Use of MFM to image the micromagnetic structure of spintronic devices**
Lucian Prejbeanu, Spintec, CEA-CNRS-UJF-INPG.
- **A25: Phase-coherent transport measurements in nano-objects**
Christopher Bäuerle and Laurent Saminadayar, CRTBT-CNRS-Grenoble.
- **A26: STM observation of electronic standing waves**
P. Mallet and Jean Yves Veuillen, LEPES-CNRS-Grenoble.
- **A27: Chemical vapor deposition of metal catalyzed silicon nanowires**
F. Dhalluin, LTM-CNRS, LETI-CEA - Grenoble.
- **A28: Simulation of Mesoscopic Transport : the Non-equilibrium Green's Function approach**
Marc Bescond, IMEP-CNRS-INPG-UJF.
- **A29: 3D profilometry and vibrometry of MEMS structures**
Bogdan Bercu, IMEP-CNRS-INPG-UJF.
- **A30: Finite Element Method (FEM) for MEMS/NEMS: static and modal analysis**
Bogdan Bercu, IMEP-CNRS-INPG-UJF.
- **A31: Low Temperature Characteristics and Transport in Advanced MOS Transistors**
Wipa Chaisantikulwat, IMEP-CNRS-INPG-UJF.

□ SESSION B PRACTICALS:

- **B02: Dictyostelium discoideum responses to mechanical forces**
Franz Bruckert and Sébastien Keller, Département de Réponse et Dynamique Cellulaires, ENSPG and CEA-Grenoble.
- **B03: The PhotoElectroChemical technique, an innovative tool for imaging chemical and mechanical properties of thermal oxide films**
Y. Wouters, A. Galerie and J-P. Petit, Ecole Nationale Supérieure d'Electrochimie et d'Electrometallurgie de Grenoble.
- **B04: Study of Actin Filaments Fragmentation by Fluorescence Spectroscopy and Video-Microscopy**
Laurent Blanchoin and Rajaa Boujemaa-Paterski, Département de Réponse et Dynamique Cellulaire, CEA-Grenoble.
- **B05: Study of biomolecular interactions by surface plasmon resonance biosensor analysis (BIAcore technology)**
Nicole Thielens, Institut de Biologie Structurale.
- **B06: Protein crystallization from a manual approach to high throughput**
Eva Pebay-Peyroula, Institut de Biologie Structurale.
- **B07: Electrochemical study of a redox molecular switch. Preparation and characterization of modified electrodes by the self-assembled monolayer and electropolymerization techniques**
Guy Royal and Christophe Bucher, Laboratoire d'Electrochimie Organique et de Photochimie Redox, CNRS-UJF.
- **B08: Initiation to Surface Plasmon Resonance (SPR) techniques**
Roberto Calemczuk and Sébastien Laurent, DRFMC/SPRAM, CEA-Grenoble.
- **B09: Controlling cell architecture by micro patterned extracellular matrix using hard lithography**
Hervé Guillou and Marc Block, LEDAC, Institut Albert Bonniot.
- **B10: Protein dynamics in living cells studied with fluorescence correlation spectroscopy and fluorescence recovery after photobleaching**
Alexei Grichine, Institut Albert Bonniot.
- **B11: Initiation to spectroscopic ellipsometry: from surface imaging to kinetic studies of biological interactions**
Pierre Labbé, Laboratoire d'Electrochimie Organique et de Photochimie Redox - CNRS.
- **B12: DNA chips fabrication using biologically fonctionnalised conducting polymers and electrospotting**
Pascal Mailley, SI3M-DRFMC, CEA-Grenoble.
- **B13: Chemistry in microsystems : Application to DNA chips and proteomics**
Guillaume Delapierre and Frédérique Mittler, LETI-CEA.
- **B14: Initiation to Quartz Crystal Microbalance with Dissipation monitoring (QCM-D)**
Liliane Guérente, Pierre Labbé, Angéline Van der Heyden, Marie Wilczewski, LEOPR, UJF-CNRS.

- **B15: Real-time monitoring of DNA hybridization, cleavage and repair processes by FRET on a EWOD fluidic microprocessor**
Didier Gasparutto, DRFMC-CEA - Grenoble and Christine Peponnet, LETI-CEA-Grenoble.
- **B16: Microfluidics for studying cell under flow**
Cécile Couzon, Claude Verdier, Laboratoire de Spectrométrie Physique, UJF-CNRS.
- **B17: Fluorescence Fluctuation Spectroscopy**
Antoine Delon, Jacques Derouard, Laboratoire de Spectrométrie Physique, UJF-CNRS.

✓ PROGRAM

SCHEDULE FOR THE SESSION A

Week 1: August 28th – September 1st

	Monday 28	Tuesday 29	Wednesday 30	Thursday 31	Friday 1
8h30-10h15	Mesoscopic transport <i>Mikhail Polyanskiy</i>	Near-field microscopies <i>Hans Hug</i>	Mesoscopic transport <i>Mikhail Polyanskiy</i>	Physics of devices <i>Enrico Sangiorgi</i>	Physics of devices <i>Enrico Sangiorgi</i>
10h45-12h30	Mesoscopic transport <i>Mikhail Polyanskiy</i>	Nanochemistry <i>Ian Hamley</i>	Nanochemistry <i>Ian Hamley</i>	Technol. of nano-fabrication <i>Giancarlo Faini</i>	Nano-optics <i>Oliver Benson</i>
14h00-15h45	Near-field microscopies <i>Hans Hug</i>	Mesoscopic transport <i>Mikhail Polyanskiy</i>	Technol. of nano-fabrication <i>Giancarlo Faini</i>	Physics of devices <i>Enrico Sangiorgi</i>	Nano-optics <i>Oliver Benson</i>
16h15-18h00	Near-field microscopies <i>Hans Hug</i>	Nanochemistry <i>Ian Hamley</i>	Physics of devices <i>Enrico Sangiorgi</i>	Nano-optics <i>Oliver Benson</i>	Technol. of nano-fabrication <i>Giancarlo Faini</i>

Week 2: September 4th – 8th

	Monday 4	Tuesday 5	Wednesday 6	Thursday 7	Friday 8
8h30-18h00	Practicals	Practicals	Practicals	Practicals	Practicals

Week 3: September 11th – 15th

	Monday 11	Tuesday 12	Wednesday 13	Thursday 14	Friday 15
8h30-10h15	Practicals	Single electron effects <i>Jan Martinek</i>	Single electron effects <i>Jan Martinek</i>	Spintronics <i>Chris Marrows</i>	Neuroelectronics <i>Peter Fromherz</i>
10h45-12h30		Spintronics <i>Chris Marrows</i>	Molecular electronics <i>Marcelo Goffman</i>	Neuroelectronics <i>Peter Fromherz</i>	Qbits implementation <i>Elisabetta Paladino</i>
14h00-15h45		Single electron effects <i>Jan Martinek</i>	Spintronics <i>Chris Marrows</i>	Qbits implementation <i>Elisabetta Paladino</i>	Industrials sites or ESRF visits
16h15-18h00		Molecular electronics <i>Marcelo Goffman</i>	Molecular electronics <i>Marcelo Goffman</i>	16h00-17h45 Neuroelectronics <i>Peter Fromherz</i>	

✓ PROGRAM

SCHEDULE FOR THE SESSION B

Week 1: August 28th – September 1st

	Monday 28	Tuesday 29	Wednesday 30	Thursday 31	Friday 1
8h30-10h15	Mechanics of molecules and biological structures Thomas Duke	Near-field microscopies Hans Hug	Mechanics of molecules and biological structures Thomas Duke	Immunochemistry and biosensors Danièle Altschuh	Immunochemistry and biosensors Danièle Altschuh
10h45-12h30	Mechanics of molecules and biological structures Thomas Duke	Nanochemistry Ian Hamley	Nanochemistry Ian Hamley	Technol. of nano-fabrication Giancarlo Faini	Microfluidics for Lab-on-chips Patrick Tabeling
14h00-15h45	Near-field microscopies Hans Hug	Mechanics of molecules and biological structures Thomas Duke	Technol. of nano-fabrication Giancarlo Faini	Immunochemistry and biosensors Danièle Altschuh	Microfluidics for Lab-on-chips Patrick Tabeling
16h15-18h00	Near-field microscopies Hans Hug	Nanochemistry Ian Hamley	Microfluidics for Lab-on-chips Patrick Tabeling		Technol. of nano-fabrication Giancarlo Faini

Week 2: September 4th – 8th

	Monday 4	Tuesday 5	Wednesday 6	Thursday 7	Friday 8
8h30-18h00	Practicals	Practicals	Practicals	Practicals	Practicals

Week 3: September 11th – 15th

	Monday 11	Tuesday 12	Wednesday 13	Thursday 14	Friday 15
8h30-10h15	Practicals	Advanced biophysics for microsystems design R. Hovius, J.M. Segura	Advanced biophysics for microsystems design R. Hovius, J.M. Segura	Advanced biophysics for microsystems design R. Hovius, J.M. Segura	Neuroelectronics Peter Fromherz
10h45-12h30		Surface and molecular physico-chemistry Ralf Richter	Surface and molecular physico-chemistry Ralf Richter	Neuroelectronics Peter Fromherz	Biological applications of microelectrodes Christian Amatore
14h00-15h45		Advanced biophysics for microsystems design R. Hovius, J.M. Segura	Advanced biophysics for microsystems design R. Hovius, J.M. Segura	Biological applications of microelectrodes Christian Amatore	Industrials sites or ESRF visits
16h15-18h00		Surface and molecular physico-chemistry Ralf Richter	ESRF visit	16h00-17h45 Neuroelectronics Peter Fromherz	
18h00-19h45				Biological applications of microelectrodes Christian Amatore	

✓ INDUSTRIAL VISITS

Visits of industries specialized in microelectronics and microsystems, situated in **Crolles** (nearby Grenoble) or ESRF are scheduled on Friday 15th September.

✓ SEMINARS

During the session, seminars will be given by researchers from the Grenoble area:
From 4th to 11th September at 7pm

- ▶ **Nanotechnology and the Future of Computing**,
S. Williams, Hewlett Packard
4th of September
- ▶ **Sweet – talk between bacteria and hosts: structure and thermodynamic of protein carbohydrate interactions**,
Anne Imberty, CERMAV – CNRS.
5th of September
- ▶ **Ferroelectricity and domain dynamics in thin perovskite films**,
Jean-Marc Triscone, DPMC, Geneva University
6th of September
- ▶ **Evanescent wave microscopy: a tool to study dynamic properties of biological polymers**,
Laurent Blanchoin, DRDC, CNRS/CEA/UJF/INRA
7th of September
- ▶ **Discussion on ethics and safety in the field of nanoscience and nanotechnology**,
Dominique Vinck, CRISTO, CNRS and UPMF, Dorothee Benoit Browaeys, VivAgora,
François Tardif, LITEN/CEA – Grenoble
8th of September
- ▶ **Quantum experiments in superconducting nano-circuits**,
Olivier Buisson, CRTBT – CNRS and UJF
11th of September

✓ SOCIAL EVENTS

- ✓ Welcome Cocktail: 28th of August, evening
- ✓ Wine & Cheese: 1st of September, evening
- ✓ Chartreuse Trip (visit of the museum or walking...): 3rd of September all the day
- ✓ “Farewell Dinner”: 15th of September, evening

✓ PRACTICAL INFORMATION



TRAVEL



International Airport

Grenoble is located 80 km East of Lyon-Satolas "Saint-Exupéry" international airport, one hour by shuttle bus, the best way to come to Grenoble.



National Airport

Grenoble-St Geoirs airport offers direct flights with Paris-Orly. A shuttle bus operates between St Geoirs airport and Grenoble bus/railway station for each arriving or departing flight (45 mn).

For your information, the cost of a taxi ride (at your own expense) Grenoble airport - Grenoble bus/railway station is approximately 60€ (add 50% on weekends or at night, duration: 35 mn).



Train

Several high speed trains (TGV) daily connect directly Grenoble and Paris-Gare de Lyon or Paris-Roissy airport (3 hours trip).



Car rentals

In Grenoble, all major car rental companies have offices at the airport or in town, most of them in front of the bus/railway station.

►► How to come to the Maison des Magistères:

- ▶ From the motorway: exit "Polygone scientifique"
- ▶ By bus from the Center of Grenoble: Bus n°34 - "Place de la Résistance" stop



ACCOMMODATION

Accommodation will be provided in a hotel located in Grenoble (including breakfast).

Students are taken in single room at the Hôtel Suisse et Bordeaux:

Hôtel** Suisse et Bordeaux

6, place de la gare

38000 Grenoble

<http://www.hotel-sb-grenoble.com> - tel: + 33 (0)4 76 47 55 87

Just opposite the hotel:

- Bus to the Scientific Center (n°34 for ESONN, from the "Gares" stop to the "Place de la Résistance" stop, it takes 10 minutes)
- SNCF train station (High Speed Train (TGV) for the main lines)
- Bus and tram station
- Covered car park (6€/day)

Lecturers will be accommodated in the Hôtel de l'Institut, in the same area:

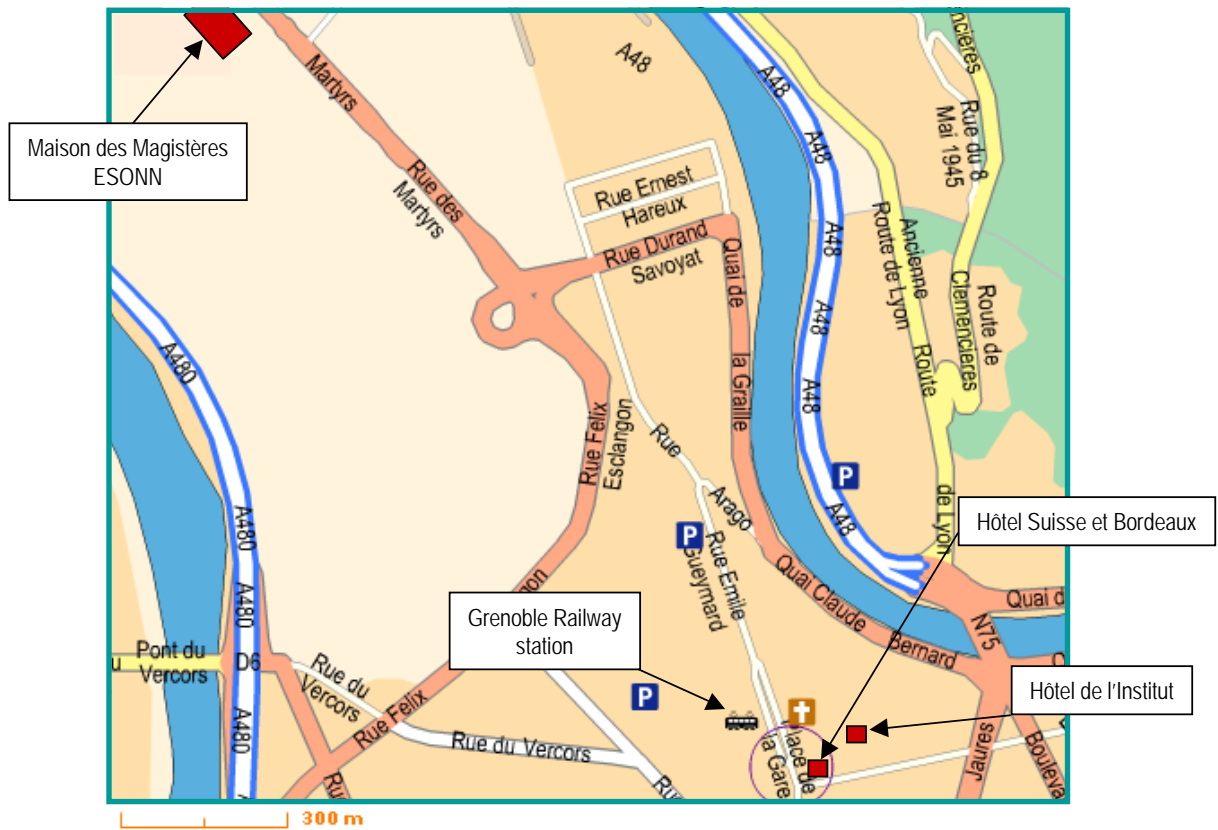
Hôtel** de l'Institut

10, rue Barbillon

38000 Grenoble

<http://www.institut-hotel.fr> - tel: +33 (0)4 76 46 36 44

☉ Lunches are planned in a canteen on the “Polygone Scientifique”, just a few hundreds meters from the Maison de Magistères where the lectures will be provided; except during the practicals.



July 2006
Booklet realised by Clotilde Effantin & Youlia Mazet



ESONN Partners:



<http://www.esonn.inpg.fr>

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