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FONDATION



# The Nanosciences Foundation & The RTRA Nanosciences at the Frontiers of Nanoelectronics



September 2009

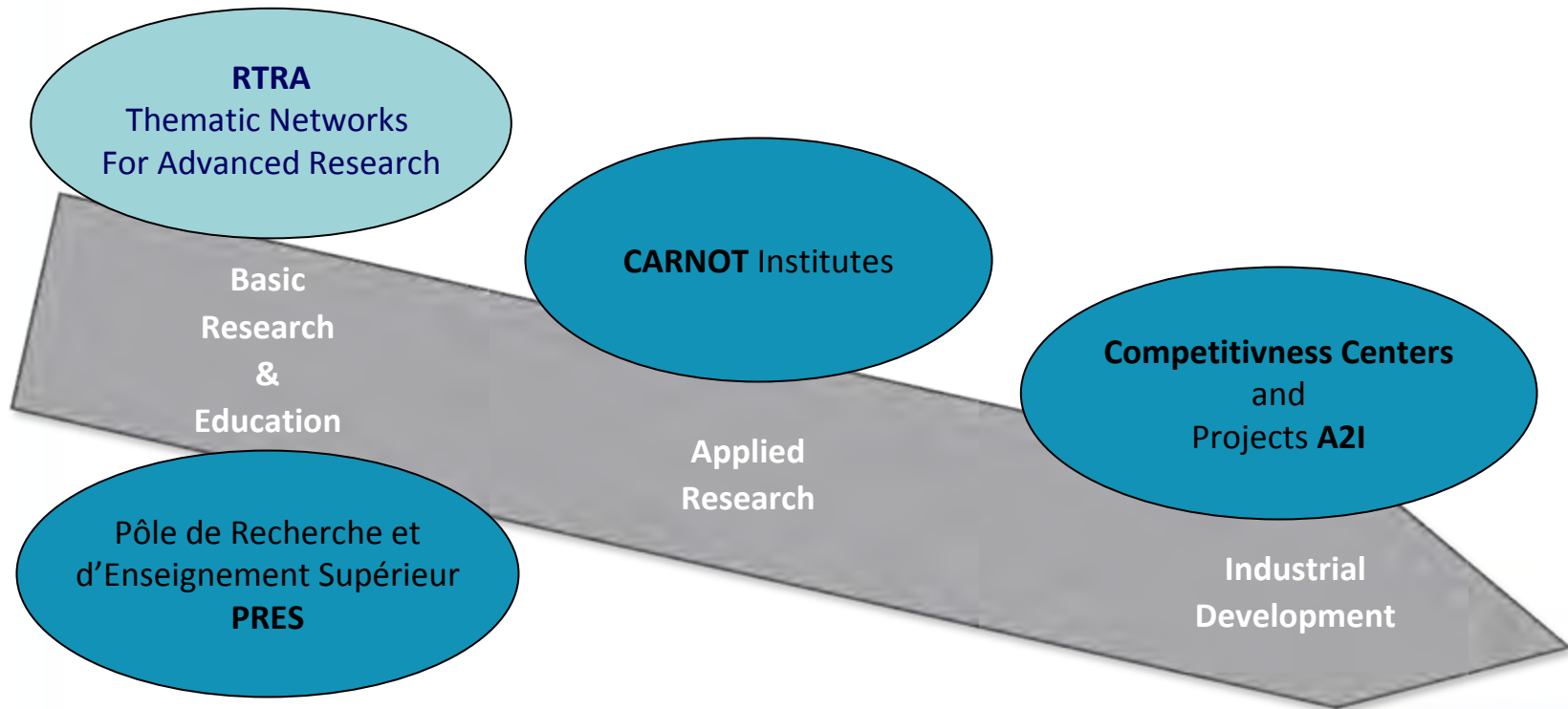
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# What is a RTRA Network?

**RTRA** : Réseaux Thématiques de Recherche Avancée

A tool launched by the government in order to promote interactions between Education, Research & Industrial areas.



# The RTRA Network in Grenoble

**RTRA**  
Thematic Networks  
For Advanced Research

There are **13 RTRA** in France ...

.... **Only two of them involve research in physical sciences :**

- **1** - RTRA “Triangle de la Physique” - Paris Area
- **2** - RTRA “Nanosciences at the Frontiers of Nanoelectronics” – Grenoble
  - The only one to be specifically dedicated to Nanosciences and Nanotechnology

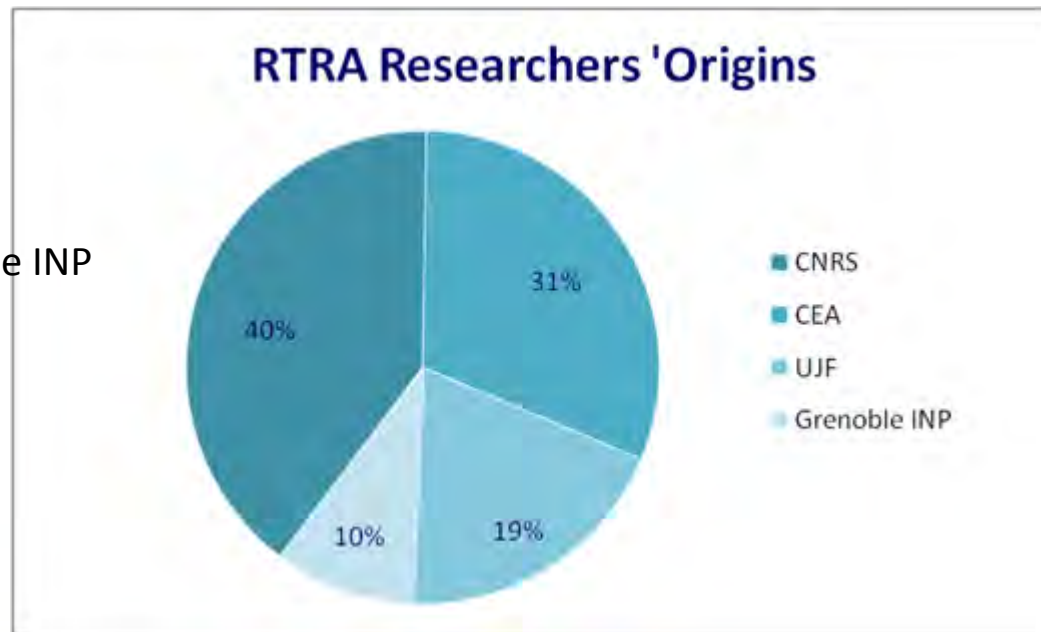
Each network is supported by one Foundation initially funded by the government and able to collect funds and gifts from individuals and/or companies.

## *The RTRA Network in Grenoble*

→ The Grenoble network is a **multi-disciplinary** and **multi-institutional collaborative research initiative** in the field of Nanosciences :

Mathematics - Computer sciences - Physics - Chemistry - Biology - Medicine - Engineering

→ The network brings together **32 laboratories**, all based in Grenoble, and therefore gathers about **900 researchers** belonging to the 4 founding institutions :



- CNRS
- CEA
- Grenoble INP
- UJF

# *The Nanosciences Network has identified 8 fields of Excellence*

- Quantum Nanoelectronics
- Nanomagnetism and spin electronics
- Nanophotonics
- Molecular Electronics
- Nanomaterials & nanostructuration
- Nanocharacterisation and metrology
- Life sciences at the frontiers of Nanoelectronics
- Nanomodeling and simulation

Applied to



- Nanoelectronics
- Biology and Healthcare
- Energy & environment

## **Technological Platforms & up to date - open facilities**

- Nanoscale fabrication
- Characterization
- Theory and simulation

# *Within the Nanosciences Network*

## Technological platforms associated with the network

### Nanofabrication

- Plateforme Technologique Amont (PTA)
- Platform CIME
- Platform Nanofab

### Nanomodelisation

- CIMENT (Intensive computation)

### Nanocharacterization

- Nanobio
- Centre for Integrated Structural Biology
- Plateforme de Nanocaractérisation (PFNC)
- CMTC (Consortium des Moyens Technologiques Communs)
- CRG (Collaborative Research Groups) - ESRF

## 7 Doctoral Schools

- Chimie et Sciences du Vivant
- Ingénierie pour la Santé, la Cognition et l'Environnement
- Matériaux et Génie des Procédés
- Mathématiques, Sciences et Technologies de l'Information.  
Informatique
- Mécanique et Energétique
- Ecole Doctorale de Physique
- Electronique, Electrotechnique, Automatique,  
Télécommunications, Signal

## 3 European Schools

- **European School On Nanosciences and Nanotechnologies**
- Higher European Research Course for Users of Large Experimental Systems
- Summer School of Mathematics



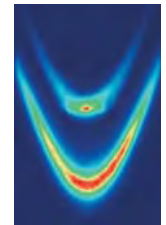
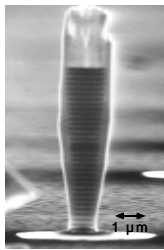
## *The RTRA Network and the Nanosciences Foundation*

The Nanosciences Foundation supports the RTRA Network in Grenoble:

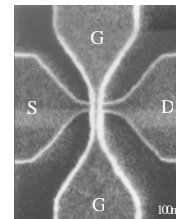
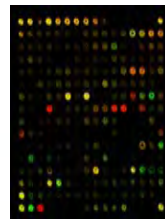
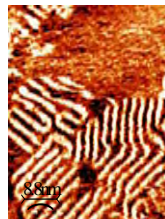
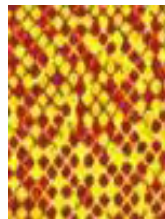
- **Budget from 2007 to 2011:** **26 M€**
    - initial funding from the government : **17,5 M€**
    - support from the 4 founding institutions : **8,5 M€**
  
  - **Other resources :**
    - income from financial investments : 3 - 4 %
    - donations from individuals and companies :
- A fundraising campaign is being organized
- **Annual budget :** from **4,5 to 5 M€**

# The Missions of the Nanosciences Foundation

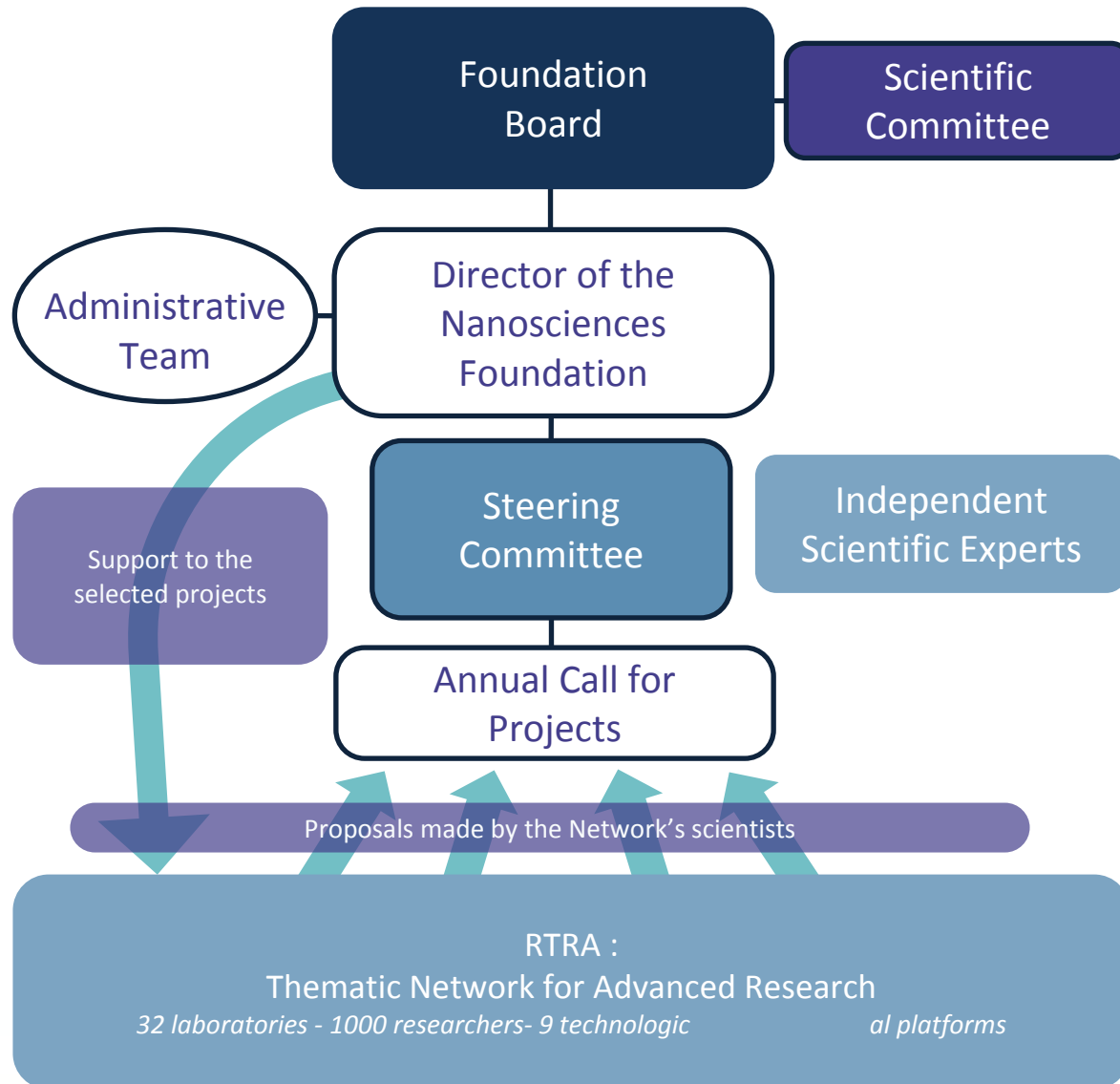
- Fostering a world class Nanosciences research in the network
- Encouraging collaborative and multi-disciplinary research
- Strengthening connections between research and higher education
- Supporting the coordinated development of shared-use facilities
- Extending international visibility of the Grenoble site



- **Basic research**
- **Focus on well defined domains**
- **Interdisciplinarity**



# Governance of the Nanosciences Foundation



# *The Nanosciences Foundation supports*

## **Chairs of Excellence** - the aim is:

- to recruit in Grenoble **high level scientists** of any foreigner nationality
- to provide them with funding to **employ PhD. students** and **Post-Docs**
- to buy equipment

## **RTRA Projects** :

- A financial support is awarded to particularly **innovative and ambitious** research projects that foster **cooperative research** between the network's laboratories

## **Young scientists** :

- Support to enroll **outstanding** Ph.D. students and Post-Docs

## **Technological platforms** :

- Development of several technological platforms that offer **up-to-date facilities**

## **Education and Scientific Animation:**

- Summer doctoral schools, Workshop, Seminars

## Supporting the RTRA through a yearly Call for Proposals

Call for Proposal	2007	2008	2009	Total 2007-2009
Committed amounts	5.92 M€	4.85 M€	2.43 M€	13.2 M€

- almost all selected projects are running (and funded) over 3 years
- more than 1/3 of the total amounts attributed to the nanotechnology platforms
- a total of 15 “Chaires d’excellence” projects have been elected
- 20 collaborative research projects are funded

	Total number	Call 2007	Call 2008	Call 2009
<b>Funded projects</b>	<b>20</b>	10	7	3
4 partners/project	3	0	1	2
3 partners/project	12	8	3	1
2 partners/project	3	1	2	0
1 partner/project	2	1	1	0

## *“Chaires d’excellence” projects selected in 2009*

<p><b>Nano-Charac-terization</b></p>	<p>* <b>John Kirtley</b> * Part time</p>	<p><b>Nanocharacterization of Superconducting Nanostructures</b></p> <p>John R. Kirtley, one of the world’s leading experts on Josephson junction devices and superconductivity, will join this project aimed at the study of the physical properties of high quality superconducting films and their integration into quantum nano-devices.</p> <p>Epitaxial superconducting films will be grown by MBE and characterized at the nanoscale at room temperature as well as at very low temperature. The epitaxial trilayers will be patterned into phase qubits.</p> <p>Novel nanoSQUID microscopy techniques will be employed to image the high quality circuits.</p>	<p><u>Institut Née</u> <u>SIMAP</u> <u>INAC</u></p>	<p>350</p>
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## *“Chaires d’excellence” projects selected in 2009*

<p><b>Nano-modeling</b></p>	<p>* <b>Normand Mousseau</b> * Part time</p>	<p><b>MUSCADE: Multi-scale Design of Nano-materials with simulations on hybrid architectures</b></p> <p>The core of this project is the true integration of Professor Normand Mousseau from the Université de Montréal into a local organization regrouping both physicists and computer scientists belonging to all the 4 institutions in Grenoble, CNRS, CEA, INPG and UJF, and working on condensed matter and nanostructures.</p> <p>Through the study of three prototype systems motivated by the experimental community, multiscale simulations are expected to advance our fundamental understanding of the key issues governing the formation and stability of semiconducting quantum dots, silicon nanowires and graphene sheets.</p>	<p><a href="#">INAC</a> <a href="#">SIMAP</a> <a href="#">Institut Néel</a> <a href="#">LIG</a> <a href="#">LETI</a></p>	<p>280</p>
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## *“Chaires d’excellence” projects selected in 2009*

<p style="text-align: center;"><b>Nano- photonics</b></p>	<p style="text-align: center;">* <b>Yong Zhang</b> * Part time</p>	<p><b>II-VI Photovoltaics: New concepts solar cells with II-VI semiconductor nanostructures</b></p> <p>Yong Zhang is an expert in both optical spectroscopy and electronic structure computation, and is involved in optoelectronic applications of materials (e.g., solar cell, solid state lighting, thermoelectrics).</p> <p>The goal of the project is to validate and combine new ideas for solar cells along three axis: 1/Type II band alignment at the interfaces, 2/1D architecture, using arrays of II-VI wires, 3/Direct band gap II-VI semiconductors. It will be done by exploring a new class of photovoltaic cells, based on core/shell nanowires architecture with type II band alignment such as ZnO/CdTe and ZnTe/CdSe.</p>	<p style="text-align: center;"><u>Institut</u> <u>Néel</u> LETI LTM</p>	<p style="text-align: center;">300</p>
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## *Collaborative RTRA projects selected in 2009*

<b>Quantum Nano- electronics</b>	RTRA project 2009	<b>TRANSPIN: Coherent transport of a single electron spin</b> The goal of this project is to realize coherent transport of a single electron spin in a scalable condensed matter system (lateral quantum dots defined in a GaAs heterostructure). The realization of teleportation of a single electron spin will open new possibilities to the field of Quantum Information and is an essential step towards coherent control of a large number of Q-Bits.	<u>Institut</u> <u>Néel</u> IMEP TIMA	230
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## *Collaborative RTRA projects selected in 2009*

<b>Nano-magnetism</b>	RTRA project 2009	<b>MIDWEST: Magnetic Microscopies for the detailed study of the interaction between magnetic Domain Walls and Spin-Polarized currents</b> The objective is to establish a local platform for magnetic imaging particularly suited for current-induced domain wall motion, which will be unique in France and even worldwide, to be able to address the open questions in the field and produce ground-breaking results in the coming years in this competitive and fast-moving field.	<a href="#">Institut Néel</a> INAC SPINTEC	250
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## *Collaborative RTRA projects selected in 2009*

<b>Nano- materials</b>	RTRA project 2009	<b>PERCEVAL: Phase transformation and small scale effect: study of materials for phase change random access memories (PC RAM)</b> The main target of the project is the study of the effect of reducing dimensions on phase transitions in new materials candidate for PCRAM. Special focus will be made on the effect of scaling on the variability of material composition in an array, the variation of melting temperature and the shift in crystallization. The studied materials will be $\text{Ge}_2\text{Sb}_2\text{Te}_5$ , GeTe and $\text{GeSb}_6$ . $\text{Ge}_2\text{Sb}_2\text{Te}_5$ (GST) is considered as a reference materials.	LETI INAC LMGP LTM	280
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## Support to the Nanotechnology Platforms

More than 1/3 of the budget since 2007

Montants en k€	<i>Total</i>	<i>Nano fabrication</i>	<i>Nanochimie biologie</i>	<i>Nano caractérisation</i>	<i>Nano simulation</i>
<b>Total</b>	<b>4.892</b>	2.305	712	1.740	135
<b>2007</b>	1.443	665	203	440	135
Fonct.	332	300	32		
<b>2008</b>	2.027	420	307	1.300*	0
Fonct.	320	300	20		
<b>2009</b>	520	370	150	0	0
Fonct.	250	250	0		

\* Dual Beam Focus Ion Beam

## *Support to Nanotechnology Platforms in 2009*

<b>Platform</b>	<b>Equipment</b>	<b>Funding (k€)</b>
<b>PTA CIME</b>	Operating expenses	250
	High temperature LP CVD system	220
<b>NanoBio</b>	Mass spectroscopy for bio-molecules	150
<b>NanoFab</b>	Silanisation system	120

# *The Nanosciences Foundation Today*

**In September 2009, the Foundation already supports 42 scientists worldwide**

**→ 9 Chairs of Excellence:**

*Australia, Belgium, Russia, Spain, Ukraine,  
USA [CalTech Institute, Stanford, Yale and Brown University]*

**→ 8 Post-Doctoral researchers:**

*China, France, Germany, Italia, Russia, Spain, USA*

**→ 25 PhD students:**

*Brazil, China, Czech Republic, France, India, Iran, Korea, Poland, Romania*

# The Full-time “Chairs of Excellence” of the Nanosciences Foundation

**Tetiana Aksenova**

*Life sciences at the frontiers of Nanoelectronics*



Senior Research Scientist titled by Ukrainian Academy of science  
leading expert in the field of knowledge mining, machine learning and real time calculation.

Brain Computer Interface (MR BCI) - LETI

**Mairbek Chshiev**

*Nanomagnetism*



Ph.D. degree from Moscow State University (Russia)  
Center for Materials for Information Technology at the University of Alabama

Theory of spin-dependent electronic transport phenomena in nanostructures - SPINTEC

**Donald Martin**

*Life sciences at the frontiers of Nanoelectronics*

University of Technology Sydney (UTS).  
Research focused on ion channels in cell membranes.

Design of biomimetic artificial membranes able to build ionic gradients. Such cellular systems will be implemented in devices harvesting electrochemical energy - TIM C



# The Part-time “Chairs of Excellence” of the Nanosciences Foundation

Researcher	Project Title	Origin	Started in
<b>V. Bayot</b> 2,5 m/year x5	<b>Scanning-gate Nanoelectronics</b> Specialist of ballistic transport and quantum Hall effect in low-dimensional electronic systems and mesoscopic physics, mostly in III-V compounds.	Louvain Catholic University <i>Belgium</i>	April 2008
<b>M. Roukes</b> 3 m/year x 4	<b>Very Large Scale Integration of NEMS</b> His group is building systems with a range of applications that span fundamental measurement, engineering, and biological and medical sciences.	Californian Institute of Technology <i>USA</i>	May 2008
<b>P. Wong</b> 1m/year x3	<b>Transport in core/shell devices</b> New concepts in circuit and system designs, explorations into device-driven circuits and systems .	Stanford University <i>USA</i>	June 2008
<b>V. Holy</b> 1 m/year x4	<b>RX interaction with nanoparticles ‘ surface</b> His expertise is particularly focused on the quantum objects prepared in situ on the beam lines (ESRF) and on the nano-defects induced in silicon by the technological processes.	Masarik University <i>Czech Republic</i>	July 2008
<b>L. Glazman</b> American 3m/year x3	<b>Quantum coherent phenomena</b> This project will permit to make progress towards the fabrication of devices based with new functionalities, including quantum bits.	Yale University <i>USA</i>	July 2008
<b>J. Fernandez-Rossier</b> 1,5 m/year x3	<b>Downsizing spintronics</b> Control of the quantum state of a single magnetic atom sitting in a II-VI semiconductor quantum dot.	Alicante University <i>Spain</i>	September 2008



# *The Nanosciences Foundation is an employer*

## **Chairs of Excellence:**

- A senior scientist may earn **3500 to 4500 €/month**
- A junior scientist may earn **3300 to 3800 €/month**

## **Post-Doc researchers:**

- For 12 to 24 months: **2300€/month**

## **PhD students:**

- For 36 months: **1550€/month**

The Foundation is looking for outstanding candidates  
for PhD. and Post Doc positions.

Important to implement **trusting partnerships** with « sister institutions » in **foreign countries** in order to arrange successful exchanges of high-level scientists based on:

- reciprocal good knowledge of the research activities
- support for scientific collaborations
- confidence in the scientific skills of the candidates



# Stratégie pour le Développement de la Fondation

## Préparation d'une campagne de Levée de Fonds

Choix d'un Consultant en Fund raising :

Cabinet Iain More Associates

- Stratégie en 3 phases :

**Phase 1 : argumentaire, évaluation interne**

*terminé*

**Phase 2 : test de l'argumentaire**

*en cours*

- pour évaluer l'adhésion de partenaires potentiels aux ambitions et à la vision de la Fondation.
- pour tester le niveau de soutien et de dons pouvant être espéré

**Phase 3 : conduite de la campagne**

*décembre 2009 – mai 2010*

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## Développement de la Fondation

### Comité de Parrainage :

- **Albert Fert** : Prix Nobel de Physique 2007, Professeur à l'Université de Paris-Sud (Paris XI)
- **Jean Therme** : Directeur du CEA Grenoble
- **Francesco Sette** : Directeur Général de l'ESRF (*European Synchrotron Radiation Facility*)
- **Joël Monnier** : Fondateur de la start-up Kalray et ancien Vice-Président et Directeur de la R&D de STMicroelectronics
- **Alim-Louis Benabid** : membre de l'Académie des Sciences, Professeur émérite de Biophysique à l'UJF, Conseiller Scientifique au CEA (DRT)
- **Etienne Klein** : Physicien et Docteur en philosophie des sciences, Directeur de Recherches au CEA Saclay, Directeur du LARSIM (Laboratoire de Recherche sur les Sciences de la Matière)
- **Michel Bruel** : Conseiller Scientifique au CEA LETI et Fondateur de la société de conseil APLINOV
- **Axel Kahn**, médecin généticien, Président de l'Université Paris Descartes (Paris V)
- **Jean-Lou Chameau**, Président du Californian Institute of Technology
- **Eva Pebay-Péroula**, Membre de l'Académie des Sciences, Directrice de l'IBS, Professeur UJF

# Conclusion

## The Nanosciences Foundation and its RTRA Network are:

- Fostering collaborative research in Nanosciences in Grenoble
- Supporting multidisciplinary and transversal projects
- Improving the international visibility and attractiveness of Grenoble

Please visit our website : [www.fondation-nanosciences.fr](http://www.fondation-nanosciences.fr)

# ***Direction and Administrative staff of the Nanosciences Foundation***

## **Director**

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## ***A summary of the Nanosciences Foundation history***

- First informal contacts and discussions 2006, April-May
- Tentative CA & working group 2006, September 1<sup>st</sup>
- The RTRA « Nanosciences » is selected 2006, October 4<sup>th</sup>
  
- Executive order by the government 2007, February 19<sup>th</sup>
- First meeting of the Board (CA ) 2007, March 23<sup>rd</sup>
- First Call for Proposals 2007, June
  
- Second call for Proposals 2008, January
- First Scientific Council Meeting 2008, June 23<sup>rd</sup> – 24<sup>th</sup>
- Official Launching Ceremony 2008, September 19<sup>th</sup>
- Third call for Proposals 2008, December