

**INSTITUTION**

Name	Centre National de la Recherche Scientifique
Acronym	CNRS
Category	Research Institute
URL	http://www.cnrs.fr

**GROUP**

Name	Groupe de Physique des Etats Condensés
Acronym	GPEC
URL	http://www.gpec.univ-mrs.fr
Address	Faculté des Sciences de Luminy GPEC - Case 901
City	Marseille
Zip	13288
State	
Country	France
Phantoms member	<input checked="" type="checkbox"/>
NID member	<input checked="" type="checkbox"/>

**CONTACT PERSON**

First name	Didier
Middle name	
Last name	Tonneau
Telephone	+33 4 91 82 92 64
Fax	+33 4 91 82 91 76
E-mail	tonneau@gpec.univ-mrs.fr
Personal URL	

**AREAS OF EXPERTISE**

**Expertise**

Proximal probe assisted lithography (Atomic Force Microscopy(AFM), Scanning Tunneling Microscopy(STM) and Scanning Near Field Optical Microscopy(SNOM))(SPMs)  
Electronic transport in metallic or silicon based nanostructures

**INSTRUMENTS & EQUIPMENT AVAILABLE**

Atomic Force Microscope (AFM / SPM)(Park M5 + NT-MDT + Veeco)  
Scanning Tunneling Microscope (STM) (1 low/high temperature, 3 Omicron STM)  
Scanning Electron Microscope(SEM) + Focused Ion Beam(FIB) (planned for November 2001)

**RESEARCH AREAS**

**NanoTechnology for information processing storage and transmission**  
Nanoelectronics, materials and devices

**Long-term research with generic applications**  
Quantum physics, mesoscopic systems, chemical

**Instruments and equipment, supporting sciences and technologies**  
Design of new equipments based on proximal probes  
Analytical equipment and techniques

**PROJECTS**

Name[Acronym]	Agency	Participation	EU
CREMSI		Partner	<input checked="" type="checkbox"/>
Fabrication and Architecture of Single			<input type="checkbox"/>

## Report 4. RANNS

### Performed in collaboration with University College London, UK

The fourth "Focused Phantoms Report" (The Status of Research into Architectures for Nanoelectronics and Nanophotonic Systems in the European Research Area – RANNS) prepared in collaboration with Prof. Michael Forshaw (University College of London, UK) was revised during the last reporting period and will be published in the Phantoms WEB site (restricted area).

The report is a short 'preliminary review', based mainly on web-searching. It contains information on **research in Europe** on a graded range of topics, from nanodevice circuits, system architectures and fault tolerance, to system performance prediction. Some information is also provided on the **availability in Europe of researchers and training courses**.

The final report contains information in the form of lists, tables or charts. The technical coverage of the report mainly deals with nanoelectronic systems. Information related to this field is scattered through hundreds, if not thousands, of research papers, reviews and books. It is *not* the aim of the report to contain an exhaustive (and exhausting) review of the field. Instead, the aim was to keep the report short, readable and informative. *The report would not be a 'tutorial' – it would be intended to act as a stimulus to guide subsequent activities in the field.*

The report includes summaries of work in progress in the following areas:

1. *Existing and proposed devices;*
2. *Small and ultra-large circuits: theory and practice*
3. *Conventional architectural concepts - 'System on a chip', 3D systems et cetera.*
4. *Known problems*
5. *Unconventional and new concepts*
6. *Applications – performance requirements*
7. *Availability and training of human resources*

## **WP6: Dissemination of Information and Results**

### PHANTOMS Newsletter

The printed Phantoms newsletter was distributed on a regular basis to keep PHANTOMS members aware of the network evolution (new members and activities, grants, collaborations with industry and other networks, jobs, conferences, scientific articles, reports on network activities, publication highlights, etc.). This document was primarily intended as an information platform for network partners and a way to stimulate opportunities for mutual gain. Members were encouraged to publish hot results as well as short review papers on research areas mapped by PHANTOMS (see below).

This document was distributed worldwide scale (printed version) and a short version published in the public WEB site: <http://www.phantomsnet.net/html/newsletters.php> - pdf format downloadable document.

Full pdf version was restricted to members and associated members (joint collaborations between PHANTOMS and other entities or networks such as NEXUS).

Scientific articles published (27):

1. ***"PHANTOMS: Nanotechnology Network for Information Processing and Storage"*** by Antonio Correia (PHANTOMS Coordinator, Spain)
2. ***"Nanolmprint Lithography: Exploring some options"*** by Clivia Sotomayor Torres et al. (Univ. Wuppertal, Germany)
3. ***"A new initiative to face the challenges of micro and nanotechnologies integration: MINATEC"*** by Jean-Charles Guibert (MINATEC, France)
4. ***"When disorder becomes relevant: going down to atom-size wiring"*** by A.Garcia-Martin and Juan Jose Saenz (Univ. Karlsruhe, Germany and UAM, Spain)
5. ***"Nanotechnology Research at NASA Ames"*** by Meyya Meyyappan (NASA, USA)
6. ***"Nanowires: a brief overview"*** by Ron Reifengerger (Purdue University, USA)
7. ***"DNA: the miracle molecule"*** by Julio Gomez Herrero et al. – (Univ. Autonoma de Madrid, Spain)
8. ***"Proximal Probe Assisted lithography and application to nanodevice elaboration"*** by Didier Tonneau et al.- (Univ. Marseille, France)
9. ***"Nano-Fabrication with focused ion beams: A promising technique for magnetic patterning"*** by R. Hyndman et al. – (UPR CNRS, France)
10. ***"A revisited concept for parallel e-beam lithography"*** by P. Legagneux et al. – (Thales Research & Technology, France)
11. ***"Nanostructure Self-Assembly from monolayer protected clusters (MPCs) of gold"*** by M. Brust et al. – (Univ. of Liverpool, UK)
12. ***"Microwave single walled carbon nanotubes purification"*** by M.T. Martinez et al. – (Inst. de Carboquímica, CSIC, Spain)
13. ***"Theoretical characterisation of electronic switches based on organic conjugated molecules"*** by J. Cornil et al. – (Univ. of Mons-Hainaut, Belgium)
14. ***"NANOMASS project: smart NEMS system for high sensitivity mass detection"*** by F. Perez-Murano et al. - (NANOMASS Consortium, Spain) ***"Photoreflectance***

- Spectroscopy of Semiconductor Device Structures*** by J. Misiewicz, G. Sek and R. Kudrawiec – (Wroclaw Univ. of Technology, Poland)
16. ***"Atomic Nitrogen and Phosphorus Trapped in Buckminsterfullerene"*** by J. A. Larsson and J. C. Greer – (NMRC, Ireland)
  17. ***"Numerical investigation of shot noise suppression in chaotic cavities"*** by P. Marconcini, M. Macucci, G. Iannaccone and B. Pellegrini - (Univ. of Pisa, Italy)
  18. ***"Gate-controlled electron transport in in-situ grown self-assembled networks of single wall carbon nanotubes"*** by L. Marty, V. Bouchiat, C. Naud, M. Chaumont, T. Fournier and A.M. Bonnot – (LEPES-CNRS, France)
  19. ***"Highlights from DNA-based electronic project (IST-199-13099)"*** by A. Filoramo, C. Dekker, U. Sivam, C. Schönenberger, M. E. Michel-Beyerle – (CEA/Motorola, France)
  20. ***"BIOAND Project: Developing methodologies towards nanoelectronic-devices using nanoparticles assembled by DNA and Proteins"*** by R. Eritja et al. - (CSIC, Spain)
  21. ***"Nano-Femto Science at INRS - EMT"*** by F. Rosei, A. Pignolet, M.A. El Khakani, H. Pepin, J.-C. Kieffer, M. Chaker – (Univ. of Quebec, Canada) ***"Evidence of donor-triad cluster in GaN and Ga As"*** by A. Ferrera da Silva, C. Persson, P. Norman, J. Souza de Almeida, A.J. da Silva & R. Ahuja
  23. ***"The Bottom Up Nano-Machines (BUN) IST FET Project"*** by C. Joachim et al. – (CEMES/CNRS, France)
  24. ***"NANOTCAD Project: Nanotechnology Computer Aided Design"*** by Giuseppe Iannaccone et al.
  25. ***"Bridging Nano and Macro Worlds with Water Meniscii "*** by Ricardo Garcia and Calvin F. Quate. **(letter)**
  26. ***"Self Assembled Single Wall Carbon Nanotubes Field Effect Transistors and AFM Tips Prepared by Hot Filament Assisted CVD "*** by L. Marty, V. Bouchiat, A. Iaia, M. Faucher, C. Naud, M. Chaumont, T. Fournier, A.M. Bonnot. **(letter)**
  27. ***"Electron-Hole Symmetry in a Semiconducting Carbon Nanotube Quantum Dot"*** by Pablo Jarillo-Herrero, Sami Sapmaz, Cees Dekker, Leo P. Kouwenhoven and Herre van der Zant **(letter)**

Scientific reports (4):

1. CERION II Report 1: ***"Quantum Information and Decoherence in Coupled Nanosystem"***
2. CERION II Report 2: ***"Nanophotonics"***
3. CERION II Report 3: ***"Bio- and Molecular Electronics"***
4. CERION II Report 4: ***"Magnetoelectronics and Spintronics"***

The principal aim of the PHANTOMS Newsletter is to provide information in the field of Nanotechnology for information processing and storage. Each issue includes scientific review articles, upcoming conferences, Nano-vacancies and updated news on the network such as new members, NID workshops details and other relevant information.

The first issue of the PHANTOMS Newsletter was provided at the 8<sup>th</sup> MEL-ARI/NID Workshop in July 2001 (Wuerzburg, Germany). 150 copies of this publication were printed. A pdf version is also available.

The second issue was distributed among PHANTOMS members during the 1<sup>st</sup> PHANTOMS meeting (250 copies were printed). A pdf version is also available.

The third issue was sent exclusively to PHANTOMS members by mail (150 copies were printed). A pdf version is also available.

The fourth issue was distributed at the 9<sup>th</sup> MEL-ARI/NID Workshop in February 2002 (Catania, Italy). It was sent as well to several research institutes related to Nanoelectronics. It was distributed among the NanoCiencia Network members during its first network meeting (600 copies were printed). A pdf version is also available.

The fifth issue was sent to PHANTOMS members by mail (350 copies were printed) and distributed among the NanoCiencia Network members. A pdf version is also available.

The sixth issue was distributed at the 10<sup>th</sup> MEL-ARI/NID Workshop in July 2002 (Helsinki, Finland). It was sent as well to PHANTOMS members by mail (350 copies were printed). A pdf version is also available.

The double issue 7/8 was sent to PHANTOMS members by mail (425 copies were printed). It was distributed at the TNT2002 International Conference (Santiago de Compostela, Spain). A pdf version is also available.

The 9<sup>th</sup> issue was sent to PHANTOMS members by mail (325 copies were printed). It was distributed at the "Nano2003" Conference, Madrid (Spain): March 24-28, 2003; and at "Nanotech2003 + Future" Conference, Tokyo (Japan): February 26-28, 2003. A pdf version is also available.

The double issue 10/11 was sent to PHANTOMS members by mail (325 copies were printed). It was distributed at the 12<sup>th</sup> MEL-ARI/NID Workshop in June 2003 (Cork, Ireland). A pdf version is also available.

The double issue 12/13 was sent to PHANTOMS members by mail (300 copies were printed). A few copies were distributed at the 13<sup>th</sup> NID Workshop in February 2004 (Athens, Greece). A pdf version is also available.

The 14<sup>th</sup> issue was sent to PHANTOMS members by mail (300 copies were printed). A few copies were distributed at the 13<sup>th</sup> NID Workshop in February 2004 (Athens, Greece). A pdf version is also available.

The 15<sup>th</sup> issue was sent to PHANTOMS members by mail (300 copies were printed). A few copies were distributed at the 14<sup>th</sup> NID Workshop in June 2004 (Agelonde, France). A pdf version is also available.

The 16<sup>th</sup> issue was sent to PHANTOMS members by mail (325 copies were printed). A few copies were distributed at the TNT2004 International Conference in September 2004 (Segovia, Spain). A pdf version is also available.

The 17<sup>th</sup> issue was sent to PHANTOMS members by mail (1000 copies were printed). Copies will be distributed at the 15<sup>th</sup> NID Workshop in January/February 2005 (Madrid, Spain) and in several other high-level conferences. A pdf version is also available.

A **Short version** of each PHANTOMS Newsletter issue (free download – pdf format) was also added to provide an overview of the network activities to non-members. The corresponding file is always in the top-ranking of the most downloaded files – see examples below:

Most Downloaded Files – June 2004				
	File	No. of Downloads	% of Total Downloads	Visits ▼
1	<a href="http://www.phantomsnet.net/LITHO/abstracts/Oral_Industrial_Day/LITHO_oral_Heidari_IndustrialDay.pdf">http://www.phantomsnet.net/LITHO/abstracts/Oral_Industrial_Day/LITHO_oral_Heidari_IndustrialDay.pdf</a>	366	1.24%	173
2	<a href="http://www.phantomsnet.net/files/newsletters/Hot_Newsletter10_11_DNAproject.pdf">http://www.phantomsnet.net/files/newsletters/Hot_Newsletter10_11_DNAproject.pdf</a>	275	0.93%	154
3	<a href="http://www.phantomsnet.net/files/newsletters/Newsletter_15_Preview.pdf">http://www.phantomsnet.net/files/newsletters/Newsletter_15_Preview.pdf</a>	<b>4,103</b>	13.99%	95
4	<a href="http://www.phantomsnet.net/files/nanoindex/JBrugger_IST2003.pdf">http://www.phantomsnet.net/files/nanoindex/JBrugger_IST2003.pdf</a>	155	0.52%	94
5	<a href="http://www.phantomsnet.net/LITHO/Map_AGELONDE.pdf">http://www.phantomsnet.net/LITHO/Map_AGELONDE.pdf</a>	221	0.75%	86

Most Downloaded Files – July 2004				
	File	No. of Downloads	% of Total Downloads	Visits ▼
1	<a href="http://www.phantomsnet.net/files/newsletters/Hot_Newsletter10_11_DNAproject.pdf">http://www.phantomsnet.net/files/newsletters/Hot_Newsletter10_11_DNAproject.pdf</a>	291	0.93%	158
2	<a href="http://www.phantomsnet.net/LITHO/abstracts/Oral_Industrial_Day/LITHO_oral_Heidari_IndustrialDay.pdf">http://www.phantomsnet.net/LITHO/abstracts/Oral_Industrial_Day/LITHO_oral_Heidari_IndustrialDay.pdf</a>	254	0.81%	122
3	<a href="http://www.phantomsnet.net/files/nanoindex/JBrugger_IST2003.pdf">http://www.phantomsnet.net/files/nanoindex/JBrugger_IST2003.pdf</a>	135	0.43%	89
4	<a href="http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Oral_Ahopelto.pdf">http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Oral_Ahopelto.pdf</a>	140	0.45%	88
5	<a href="http://www.phantomsnet.net/ECSCD8/MetroMadrid.pdf">http://www.phantomsnet.net/ECSCD8/MetroMadrid.pdf</a>	119	0.38%	81
6	<a href="http://www.phantomsnet.net/files/newsletters/Newsletter_15_Preview.pdf">http://www.phantomsnet.net/files/newsletters/Newsletter_15_Preview.pdf</a>	<b>2,670</b>	8.60%	81

Most Downloaded Files				
	File	No. of Downloads	% of Total Downloads	Visits ▼
1	<a href="http://www.phantomsnet.net/TNT04/AuthorGuidelinesTNT04.pdf">http://www.phantomsnet.net/TNT04/AuthorGuidelinesTNT04.pdf</a>	630	1.90%	196
2	<a href="http://www.phantomsnet.net/TNT04/program.pdf">http://www.phantomsnet.net/TNT04/program.pdf</a>	496	1.49%	117
3	<a href="http://www.phantomsnet.net/files/newsletters/Hot_Newsletter10_11_DNAproject.pdf">http://www.phantomsnet.net/files/newsletters/Hot_Newsletter10_11_DNAproject.pdf</a>	211	0.63%	108
4	<a href="http://www.phantomsnet.net/TNT04/TNT_2004_Conference_Programme.pdf">http://www.phantomsnet.net/TNT04/TNT_2004_Conference_Programme.pdf</a>	255	0.76%	105
5	<a href="http://www.phantomsnet.net/ECSCD8/MetroMadrid.pdf">http://www.phantomsnet.net/ECSCD8/MetroMadrid.pdf</a>	165	0.49%	103
6	<a href="http://www.phantomsnet.net/TNT04/abstracts/orals/Abstract_Oral_FernandezJF.pdf">http://www.phantomsnet.net/TNT04/abstracts/orals/Abstract_Oral_FernandezJF.pdf</a>	283	0.85%	87
7	<a href="http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Poster_Docter.pdf">http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Poster_Docter.pdf</a>	119	0.35%	83
8	<a href="http://www.phantomsnet.net/TNT04/abstracts/orals/Abstract_Oral_HernandoA.pdf">http://www.phantomsnet.net/TNT04/abstracts/orals/Abstract_Oral_HernandoA.pdf</a>	124	0.37%	81
9	<a href="http://www.phantomsnet.net/TNT04/abstracts/keynotes/Abstract_Keynote_Tsukada.pdf">http://www.phantomsnet.net/TNT04/abstracts/keynotes/Abstract_Keynote_Tsukada.pdf</a>	145	0.43%	81
10	<a href="http://www.phantomsnet.net/files/newsletters/Newsletter_15_Preview.pdf">http://www.phantomsnet.net/files/newsletters/Newsletter_15_Preview.pdf</a>	<b>3,957</b>	11.93%	76



First issue of the PHANTOMS Newsletter (12 pages)



Second issue of the PHANTOMS Newsletter (16 pages)



Third issue of the PHANTOMS Newsletter (16 pages)



Fourth issue of the PHANTOMS Newsletter (20 pages)



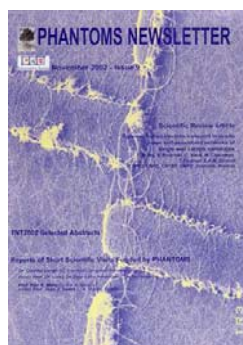
Fifth issue of the PHANTOMS Newsletter (28 pages)



Sixth issue of the PHANTOMS Newsletter (32 pages)



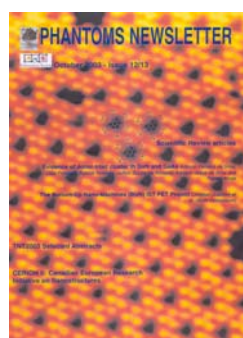
Double issue 7/8 of the PHANTOMS Newsletter (36 pages)



Ninth issue of the PHANTOMS Newsletter (36 pages)



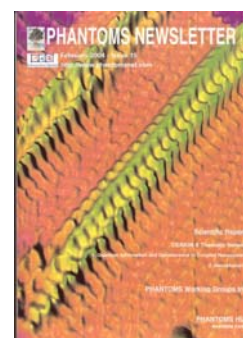
Double issue 10/11 of the PHANTOMS Newsletter (44 pages)



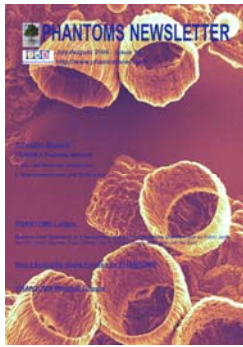
Double issue 12/13 of the PHANTOMS Newsletter (44 pages)



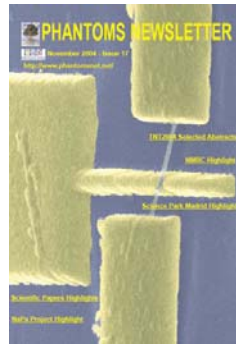
Issue 14 of the PHANTOMS Newsletter (48 pages)



Issue 15 of the PHANTOMS Newsletter (44 pages)



**PERIOD 9:** issue 16 of the PHANTOMS Newsletter (40 pages)



**PERIOD 9:** issue 17 of the PHANTOMS Newsletter (48 pages)

To enhance visibility, every six months, a scientific article published in the Phantoms Newsletter is made available for free download.

### PHANTOMS Newsletter – Hot Article

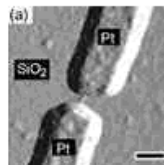
This free hot article is replaced every six months.

The screenshot shows the PHANTOMS website homepage with a grid of news items. Key items include:

- NaPa** (Emerging Nanopatterning Methods) - EU nanotechnology Integrated Project.
- NanoIndex** - Updated News, Conferences, Courses and other resources.
- PHANTOMS Report 2** - Scanning Probe Microscopy: Basic Concepts and Applications.
- PHANTOMS Newsletter Issue 16** - A thumbnail of the newsletter cover.
- PHANTOMS Newsletter Issue 17** - A thumbnail of the newsletter cover.
- Free Hot "PHANTOMS Newsletter" Article** - A link to a specific article.

At the bottom, there is a "SUBMIT" section with buttons for "News", "NanoNews", "Conferences/Courses", "Job", "Job Wanted", and "Membership". Below that is an "ABOUT" section with text describing the network's mission and membership.

#### Free Hot "PHANTOMS Newsletter" Article



"Highlights from DNA-based electronic project (IST-1999-13099)"

Free Hot Article

**Introduction**

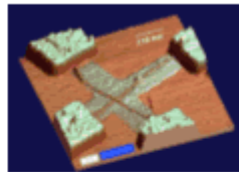
It is now accepted that Nanotechnology is one of the key enabling technologies for sustainable and competitive growth in Europe and that a significant investment is required to ensure Europe's competitiveness in nanotechnology. Global investment in this area has been growing annually during the last decade and in the last 12 months not only from programs funded by public institutions such as the European Commission, NSF or local governments but also from Venture Capitalists. Does this mean that Nanotechnology is becoming a commercial opportunity? Certainly, if we consider a few areas such as nanoelectronics, nanomaterials or metrology. Nanoelectronics is certainly now the branch with the most significant commercial impact and covers a huge range of interdisciplinary areas of research and development such as Molecular electronics, Bioelectronics, Spintronics, Nanoimprint, Nanoscale Optics, Lithography, Architecture, Nanoprobes, etc... However, most of the expected Nanotechnology applications still need long term and interdisciplinary research. Information is therefore crucial nowadays not only for researchers but also for other communities such as industrialists or investors, and is certainly the keyword to fill the gap between these three different communities.

The PHANTOMS Network scheme is promoting European science and research through a multi-national networking action, putting together research capacities present in the various European regions and stimulating commercial nanoelectronic applications.

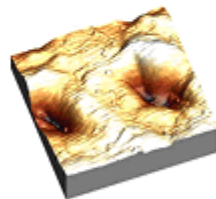
**Network purpose**

The Nanotechnology Network for Information Processing and Storage (funded by the European Commission (IST programme)) is of a truly interdisciplinary character and involves at this stage **207 partners** from 31 countries worldwide (around **2000 researchers**). Members come from government, universities and industry at the top of their fields in Europe.

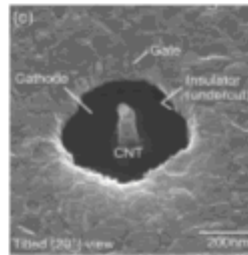
Thus linking research strategies in a consortium of participants coming from different fields and promoting exchange of researchers should foster the understanding between the groups coming from different directions. This is a crucial point that helps to ensure the competitiveness of Europe in this fast emerging field. Defining the right objectives that need to be addressed in the research and development projects can be a key to developing European competitiveness in future generations of electronics.



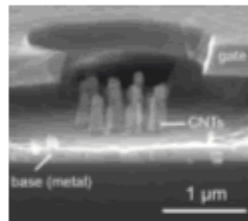
(Source: Crossed nanotubes junction formed by self-assembly on a silanized templated. CEA/Motorola)



(Source: AFM image of 50 nm holes printed in PHEMA, C.M. Sotomayor, Univ. of Wuppertal)



(Source: SEM view of single CNT growth in a microcathode, NANOLITH EU project)



(Source: Cross-sectional SEM image of a CNT field emission microcathode. P. Legaigne, THALES Research & Technology)



(Source: GaAs/AlGaAs heterostructure on top of which gates define a ballistic cavity. V.F. Bayo, CERN UCL)

The research areas addressed by the PHANTOMS Network are:

- »Modelling
- »Lithography
- »Nanoimprint/Micro contact Printing
- »Architecture
- »Nanoprobes
- »Silicon/Industry
- »Superconductors
- »Magnetoelectronics
- »Molecular and Bioelectronics
- »Nanoscale Optics
- »Self-assembly/combination of Silicon technology and molecular based electronics.

The key aspect of an emerging technology network is interaction, and this is currently achieved in the following ways:

- »Exchange of information during **workshops** organised within the network (MEL-ARL/MD and PHANTOMS)
- »Scientific exchange between partners by **short research visits** of scientists and students (PHANTOMS grants)
- »A bimonthly **PHANTOMS Newsletter**
- »**Focused reports** on research areas addressed by the network
- »**Resources for research and information exchange** (PHANTOMS Hub, preprint archive, etc...)
- »A **WEB based source** of information related to nanoelectronics based for example on:

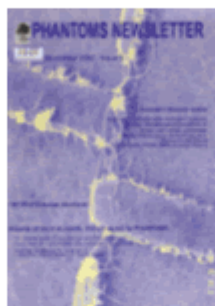
1. Database of all active research groups and companies presently involved in Nanoelectronics (Key personnel, skills, infrastructure, etc...); see **"Members Database"** for more info.
2. Dissemination of basic research results (publications, abstracts, references per group and/or topic, conference proceedings, etc...) EU reports, EU projects results (NID, FET Open, etc...), patents, etc...
3. Dissemination of information and news related to nanoelectronics such as conferences, workshops, job opportunities, grants (EU, University groups, etc.), etc. This information is updated weekly; see **"What's New"** to check new contents.

The PHANTOMS network currently allows a nanotechnology community building and integration within the European Research Area and represents a "single entry point" for those seeking information about Nanotechnology and especially Nanoelectronics.

PHANTOMS Newsletter

The principal aim of this newsletter is to provide information in the field of Nanotechnology for information processing and storage. This bi-monthly publication is supported by the EU-IST programme within the PHANTOMS Network activities (free printed copies for PHANTOMS members). Non-members should contact [Antonio CORREIA](mailto:Antonio.CORREIA).

**PHANTOMS Newsletter (Issue 9)**

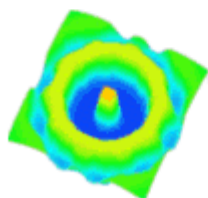


PHANTOMS HUB

This computational hub is a repository of simulation codes (currently 19) useful for modelling and design of nanoscale electron devices. Many groups in universities and research centres have developed advanced simulation software, which could be of interest for the general nanotechnology community: the mission of the PHANTOMS hub is to become the virtual venue where many of these codes can be run by registered users, sharing insights and comparing results.



WEB site:  
<http://www.phantomsnet.com/hub/>

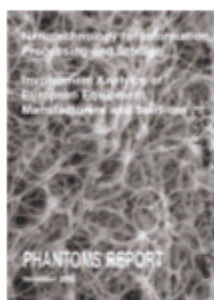


(Source: Charge difference density  $\rho(N)(C60) - \rho(C60) - \rho(N)$  in a cut plane through buckminsterfullerene with the nitrogen atom located at the centre of the cage. J.C. Greer, NMRC)

PHANTOMS Reports

This 75 pages report presents the results of the study "Nanotechnology Involvement Analysis of European Equipment Manufacturers and Start-ups" carried out within Phantoms Network activities in collaboration with "Bureau d'Etude Marketing" (CEA/DRT/BEM).

The aim of the survey was to set up a report on Nanotechnology activities of European Small and Medium Enterprises (SMEs) and specialized firms such as instrument manufacturers. This study therefore provides a clear vision of 173 European companies active in this field.



NANOINDEX Initiative

Another important objective set up by PHANTOMS is to make industry aware of the strategic importance of nanoelectronics research for the future of Information Technology (IT) in general and of microelectronics in particular. For this purpose, the network, which has currently 12% of members from industry, is promoting industrial participation within the network's activities informing the industry about relevant progress in nanoelectronics and providing a feedback loop for industrial mid and long-term interests. This objective is also being accomplished through interactions with other applications-oriented groups such as NEXUS. In this context, PHANTOMS and NEXUS have jointly set-up a concerted action entitled NanoIndex (Nanotechnology Industry Exchanges - funded by the European Union) aimed at bridging micro and nanotechnologies. The intention is to establish links between both communities and enable a better understanding of the future potential of nanotechnology in the context of microsystems-driven applications. These links will be realised for example through jointly organised workshops or the exchange of presentations and relevant information.

PHANTOMS Site Map

PHANTOMS INFO	
<a href="#">&gt;&gt;&gt; About Us</a>	
<a href="#">&gt;&gt;&gt; Advertising</a>	
<a href="#">&gt;&gt;&gt; Contact</a>	
<a href="#">&gt;&gt;&gt; Events</a>	
<a href="#">&gt;&gt;&gt; FAQ</a>	
<a href="#">&gt;&gt;&gt; Grants &amp; Funding</a>	
<a href="#">&gt;&gt;&gt; Management Board (*)</a>	
<a href="#">&gt;&gt;&gt; Members Area (*)</a>	
<a href="#">&gt;&gt;&gt; Members Database</a>	
<a href="#">&gt;&gt;&gt; Membership Request</a>	
<a href="#">&gt;&gt;&gt; News</a>	
<a href="#">&gt;&gt;&gt; Newsletters</a>	
<a href="#">&gt;&gt;&gt; Phantoms HUB</a>	
GENERAL INFO	
<a href="#">&gt;&gt;&gt; Conferences</a>	
<a href="#">&gt;&gt;&gt; FPs</a>	
<a href="#">&gt;&gt;&gt; Image Gallery</a>	
<a href="#">&gt;&gt;&gt; Jobs</a>	
<a href="#">&gt;&gt;&gt; NanoIndex</a>	
<a href="#">&gt;&gt;&gt; NanoNews</a>	
<a href="#">&gt;&gt;&gt; What's New</a>	
RESOURCES	
<a href="#">&gt;&gt;&gt; Conf. &amp; Abstracts</a>	
<a href="#">&gt;&gt;&gt; Courses</a>	
<a href="#">&gt;&gt;&gt; European Projects</a>	
<a href="#">&gt;&gt;&gt; Links</a>	
<a href="#">&gt;&gt;&gt; Software Downloads</a>	

(\*) Restricted access to members

## WP7: Self-Assessment

Six-monthly Periodic Progress Reports (Deliverables) were provided to the European Commission.

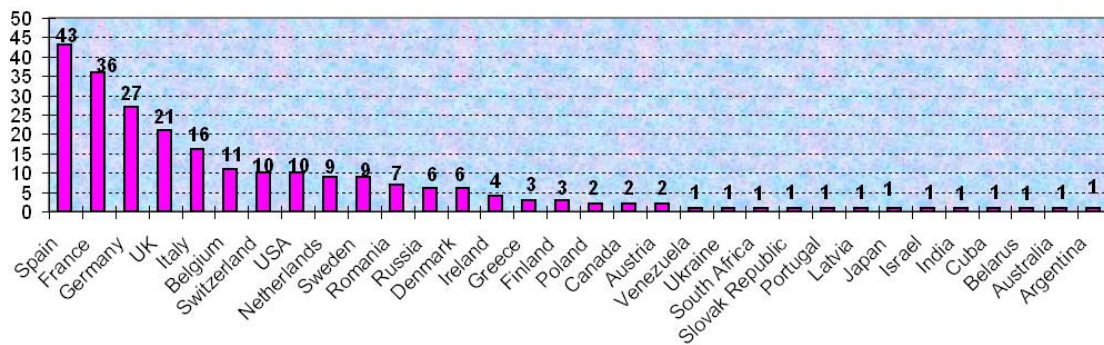
Precise criteria were defined during Management Board meetings in order to be able to monitor Network activities progress. As an example, these points were included:

- Industrial participation increase (at the start of the project, 10% of the members belongs to industry)
- Number of Network members (network size increase)
- Wider research areas coverage
- European countries coverage
- Monitoring WEB site Hits and contents (see WP 4)
- Collaboration with other national or international existing Networks (see WP 8)

Figures below show final numbers related to some of the criteria defined during the Management Board meetings:

### Percentage of members per country

Group Members per country (Total: 240)



Total PHANTOMS members: 240 (this number includes Phantoms membership requests)

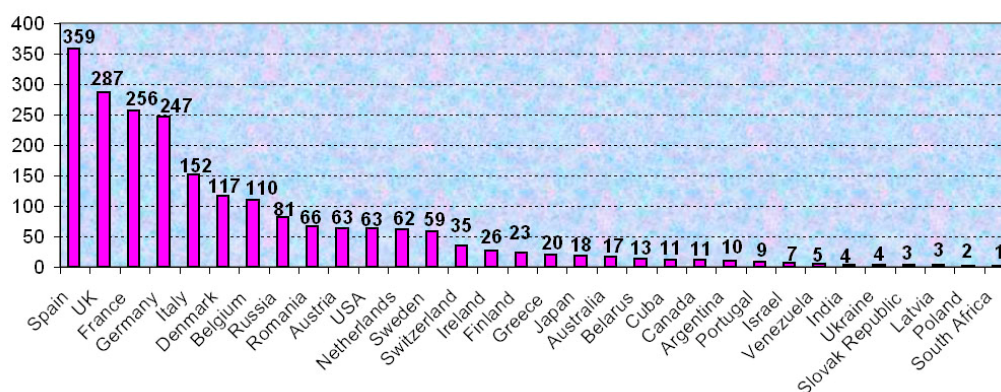
### Number of Phantoms members per country (groups)

COUNTRY	NUMBER
Spain	43
France	36
Germany	27
UK	21
Italy	16
Belgium	11
Switzerland	10
USA	10
Netherlands	9
Sweden	9
Romania	7
Russia	6
Denmark	6
Ireland	4
Greece	3
Finland	3
Poland	2

Canada	2
Austria	2
Venezuela	1
Ukraine	1
South Africa	1
Slovak Republic	1
Portugal	1
Latvia	1
Japan	1
Israel	1
India	1
Cuba	1
Belarus	1
Australia	1
Argentina	1
<b>TOTAL</b>	<b>240</b>

**Percentage of the number of people working in PHANTOMS groups per country.**

People working in Phantoms groups per country (Total: 2144)



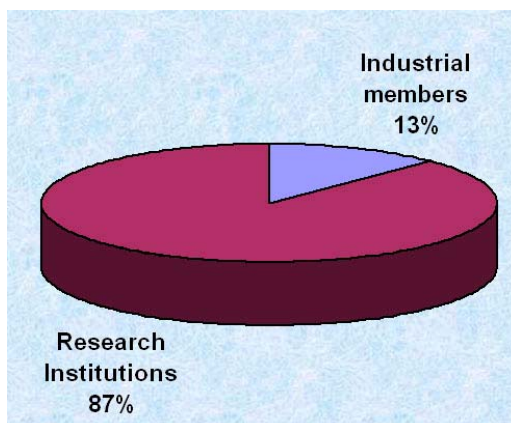
**Total People working in Phantoms groups: 2144 (this number includes Phantoms membership requests)**

**Number of people working in PHANTOMS groups per country (researchers)**

COUNTRY	NUMBER
Spain	359
UK	287
France	256
Germany	247
Italy	152
Denmark	117
Belgium	110
Russia	81
Romania	66
Austria	63
USA	63
Netherlands	62
Sweden	59
Switzerland	35
Ireland	26
Finland	23

Greece	20
Japan	18
Australia	17
Belarus	13
Cuba	11
Canada	11
Argentina	10
Portugal	9
Israel	7
Venezuela	5
India	4
Ukraine	4
Slovak Republic	3
Latvia	3
Poland	2
South Africa	1
<b>TOTAL</b>	<b>2144</b>

## Percentage of Industrial members



Total Industrial members: 30 (this number includes Phantoms membership requests)

## Companies List

COMPANY	COUNTRY
AMO GmbH	Germany
Atomistix	Denmark
CMP Cientifica	Spain
Corning S.A.	France
CSM Instruments SA	Switzerland
CYBERNETIX S.A.	France
Devices on glass technology	France
Dupont	USA
Fundación CIDETEC	Spain
Hitachi Cambridge Laboratory	UK
Horizon Technology	UK
IBM Zurich Research	Switzerland
Image Metrology ApS	Denmark
JC Naby Lithography Systems	USA
Motorola	France
Motorola Inc	USA
Nanofactory Instruments AB	Sweden
NANOEDGE	France
Nanotec Electrónica S.L.	Spain
Nanotimes	France
NanoWorld AG	Switzerland
Obducat AB	Sweden
ORSAY PHYSICS S.A.	France
Paragon Ltd.	Greece
PHILIPS Research Laboratories Aachen	Germany
Philips Research Laboratories Eindhoven	The Netherlands
Raith GmbH	Germany
Sony International Europe	Germany
STEAG microParts	Germany
THALES Research & Technology	France
<b>TOTAL</b>	<b>30</b>

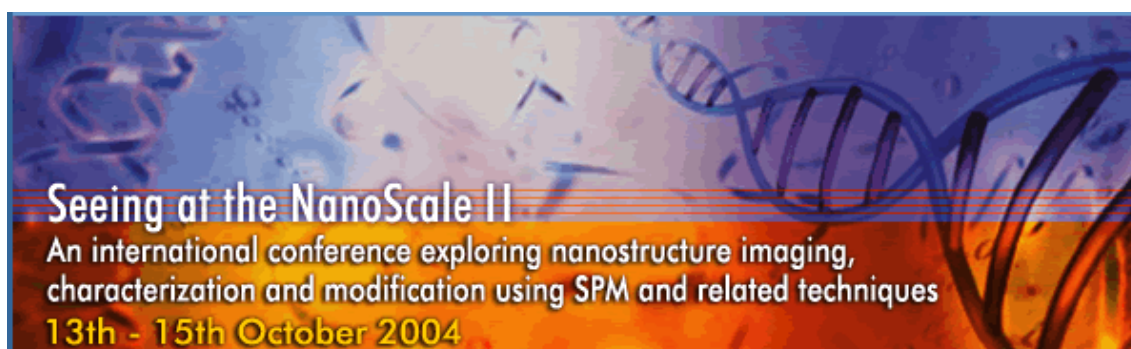
## **WP8: Collaboration with other networks & Institutions**

Phantoms developed collaborations with the following institutions and networks to promote the network and the IST/FET proactive initiative "Nanotechnology Information Devices" (NID):

- NEXUS (through NanoIndex initiative)
- CERION II (Canadian European Research Initiative on Nanostructures) – see Phantoms Newsletters n°14 and n°15
- DIODE (Designing Inorganic/Organic Devices – EU funded Human Potential Research Training Network)
- WILEY-VCH Editorial (through Dr. Rainer Waiser)
- Veeco SPM company (Seeing at the Nanoscale II Conference)

### **Veeco Instruments**

The PHANTOMS Network initiated a collaboration with the SPM company Veeco Instruments S.L. - <http://www.minatec.com/cgi-bin/charge.pl>



#### **SPONSORED BY:**



### **NanoIndex Initiative**

#### **NanoINDEX: Nanotechnology Industry Exchanges**

NEXUS and PHANTOMS have jointly set-up since June 2002 a concerted action aimed at bridging micro and nanotechnologies. Under this new activity entitled NanoINDEX (funded within the IST programme), PHANTOMS collaborated with NEXUS in order to enable a better understanding of the future potential of nanotechnology in the context of microsystems-driven applications.

Contact persons for each network:

Laurence Chassouant, NEXUS Office Secretariat - [NEXUS@cea.fr](mailto:NEXUS@cea.fr) / [www.nexus-mems.com](http://www.nexus-mems.com)

Dr. Antonio Correia, PHANTOMS Coordinator

[antonio@phantoms.net](mailto:antonio@phantoms.net) / [www.phantomsnet.net/](http://www.phantomsnet.net/)

The EU IST project ended in December 2003. However, the NanoIndex Web pages are still weekly updated.

### **CERION II**

A collaboration has been initiated with the CERION II network (Canadian European Research Initiative on Nanostructures). Both coordinators agreed that all CERION members should become PHANTOMS members – currently 8 already applied (out of 24). A description of CERION II was published in the issue n° 12/13 of the PHANTOMS Newsletter and a copy was sent to each CERION member.

The PHANTOMS network is the main dissemination channel for this initiative (see below a summary of the CERION planned activities). CERION II public deliverables were published in the Phantoms Newsletter issue 15. The second part was published in September 2004 (Issue 16).

[CERION II: Canadian European Research Initiative on Nanostructures](#)

*Fifth Framework Programme - Information Technologies and Societies (IST)*

Thematic Network in the Field of  
Physics and Technology of Nanostructures


*Supported by the Commission of the European Communities (CEC)*

**Goals of the CERION-II thematic network**

The **CERION-II** thematic network will consist of a European-Canadian consortium of members which are actively conducting research in relevant areas of the field of nanoelectronics, including the quantum theory of quantum transport in nanodevices, quantum information, nano-photonics, spintronics, molecular electronics, bio-electronics as well as the underlying nano and self assembly technology required to produce advanced nanostructures. In order to coordinate the research efforts of the CERION-II consortium that are complementary on both sides of the atlantic, the following long-term goals are put forward:

The creation of productive new collaboration links and groups of links.

- To intensify existing collaboration links from CERION-I that are consistent with the objectives and resources.
- To exchange all scientific and strategic information of common interest between all CERION-II member institutes
  - through the distribution of the annual progress report,
  - by organizing an annual workshop.
- To disseminate information concerning the activities of CERION-II to a wider target group consisting of European and Canadian universities, research institutes, microelectronics companies and European nanotechnology programmes, that are entitled to receive updated information on the research progress. This group includes various European projects that are launched in the field of nanotechnology under the 5th Framework Programme or will be launched in the forthcoming 6th Framework Programme as well as the networks of excellence being active in this field, such as the PHANTOMS Network of Excellence. In order to facilitate the dissemination of research results towards the microelectronics industry, the industrial workshops organized by the PHANTOMS Network will be used as a communication channel to inform industry on the status of the CERION-II research activities. Furthermore, special attention will be paid to the attendance of industrial participants from both sides of the Atlantic at the CERION-II workshop. Not only will the industrial representatives be invited to attend the workshop, but relevant invited speakers will be sought from industry. More generally, the workshop is open to all institutes and interested individuals although financial support cannot be generally provided.
- To disseminate all public information concerning CERION-II through the CERION-II WEB site and by exploiting the communication channels of the [PHANTOMS Network of Excellence](#).

	<p><b>DIODE: <i>Designing Inorganic / Organic Devices</i></b>  <b>EU funded Human Potential Research Training Network</b>          (Contract No.: HPRN-CT-1999-00164) /</p> <p>Coordinator: Prof. DRT Zahn (<a href="mailto:zahn@physik.tu-chemnitz.de">zahn@physik.tu-chemnitz.de</a>)</p> <p><a href="http://www.tu-chemnitz.de/diode/">http://www.tu-chemnitz.de/diode/</a></p>
---	--

Another collaboration has been set-up with the DIODE network mainly to exchange information. Such as for CERION II, a description of its network activities will be provided in one of the next PHANTOMS Newsletter.

PHANTOMS published in the restricted area the contributions (pdf format) presented during the last two DIODE training workshops held respectively in Madrid (2002) and Paderbon (2003).

## DIODE Network Objectives

### Network Aims

- **DIODE** network brings together experienced academic research groups and industrial centres with a common aim to integrate inorganic and organic materials in improved practical devices with a particular focus on high-frequency diodes for telecommunication applications.
- **DIODE** network provides highly trained researchers to secure for Europe a leading position in the exploitation of novel hybrid inorganic/organic devices going well beyond the high-frequency applications.
- Involvement of international manufacturers of inorganic semiconductors, organic molecules and end product devices ensures that new basic understanding is rapidly translated into improved technology.

### Research Motivation

- Molecular and organic materials are rapidly making a huge impact in the field of semiconductor science and technology.
- Low mobility of organic semiconductors precludes the complete replacement of compound inorganic materials. However, these materials do have a major rôle to play in the control of electronic devices based on conventional inorganic semiconductor technology.
- Inclusion of well-defined molecular layers in inorganic Schottky diodes introduces a new degree of freedom in the control of fundamental device parameters. That simple concept belies the considerable complexity of its technological realisation.

## Collaboration with Rainer Waser / WILEY-VCH Editorial

A collaboration has been initiated with Rainer Waser (PHANTOMS member) to exchange information on the textbook “Nanoelectronics and Information Technology-Advanced Electronic Materials and Novel Devices”

Publisher: Wiley-VCH

Full size / full color

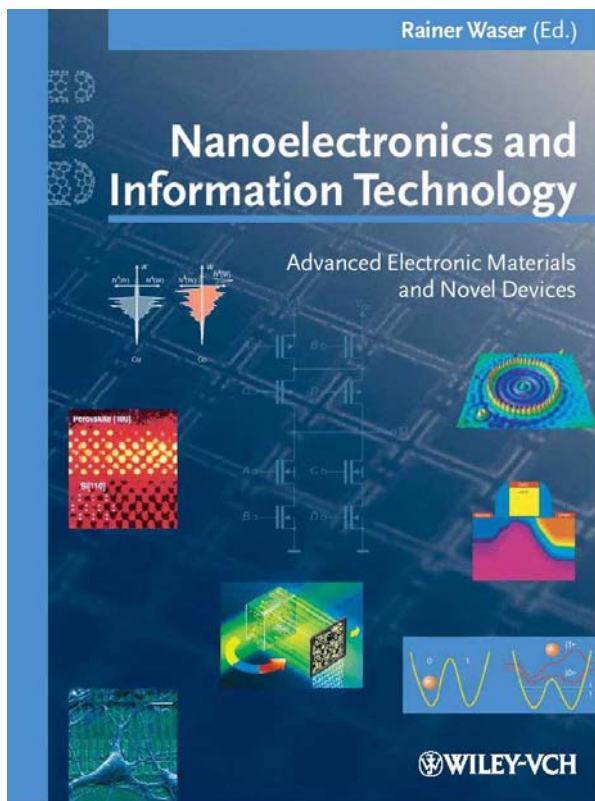
Approx. 1000 pages

EUR 74.90

It is a textbook primarily aimed at students studying physics, electrical engineering and information technology, as well as material science in their 3rd year or greater. It is equally of interest to professionals wanting a broader overview of this subject. It emphasizes the basic principles, and for this reason the book will retain its value despite the rapid developments in this field.

The editor informed us that the book is a non-profit making venture, e.g. all authors and the editor have agreed to forego their royalties, in order to keep the price within an acceptable range for students.

PHANTOMS will distribute this information through its dissemination channels (mainly the WEB site, mailing lists, Phantoms Newsletter). In exchange, Rainer Waser provided an extended set of the textbook (content without copyright) published in the network restricted area.



Rainer Waser provided an extended set of the textbook (content without copyright) published in the PHANTOMS WEB Site. Full access is restricted to PHANTOMS members.

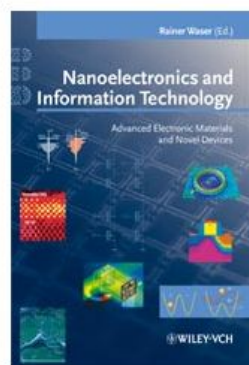


## Nanoelectronics and Information Technology

### Advanced Electronic Materials and Novel Devices

Rainer Waser (Ed.)  
 Publisher: Wiley-VCH, Berlin  
 Full size / full color - Approx. 1000 pages  
 Price: EUR 74.90  
<http://www.iwe.rwth-aachen.de/emrl/nanobook/>  
<http://www.wiley-vch.de>  
**Order Form**

### Contents and Preface



Providing an introduction to electronic materials and device concepts for the major areas of current and future information technology, the value of this book lies in its focus on the underlying principles. Illustrated by contemporary examples, these basic principles will hold, despite the rapid developments in this field, especially emphasizing nanoelectronics. There is hardly any field where the links between basic science and application are tighter than in nanoelectronics & information technology. As an example, the design of resonant tunneling transistors, single electron devices or molecular electronic structures is simply inconceivable without delving deep into quantum mechanics. This textbook is primarily aimed at students of physics, electrical engineering and information technology, as well as material science in their 3rd year and higher. It is equally of interest to professionals wanting a broader overview of this hot topic.

Full access is restricted to PHANTOMS members.

### General Introduction



Fundamentals



Technology and Analysis



Logic Devices



Random Access Memories



Mass Storage Devices



Data Transmission and Interfaces



Sensor Arrays and Imaging Systems



Displays

**James Meindl**  
 Georgia Tech, Atlanta  
*".. an absolutely masterful volume"*

**Richard W. Siegel**  
 Principal coordinator of the US National Nano-Initiative  
*"Nanoelectronics and Information Technology by Rainer Waser and his colleagues is an outstanding compendium of information about an exciting new field. Owing to its high quality and complete*

The textbook content is one of the most downloaded file every month (<http://www.phantomsnet.net/NIT/Contents.pdf>) – as an example we show below the history for July 2004.

Most Downloaded Files – July 2004				
	File	No. of Downloads	% of Total Downloads	Visits ▼
1	<a href="http://www.phantomsnet.net/files/newsletters/Hot_Newsletter10_11_DNAproject.pdf">http://www.phantomsnet.net/files/newsletters/Hot_Newsletter10_11_DNAproject.pdf</a>	291	0.93%	158
2	<a href="http://www.phantomsnet.net/LITHO/abstracts/Oral_Industrial_Day/LITHO_oral_Heidari_IndustrialDay.pdf">http://www.phantomsnet.net/LITHO/abstracts/Oral_Industrial_Day/LITHO_oral_Heidari_IndustrialDay.pdf</a>	254	0.81%	122
3	<a href="http://www.phantomsnet.net/files/nanoindex/JBrugger_IST2003.pdf">http://www.phantomsnet.net/files/nanoindex/JBrugger_IST2003.pdf</a>	135	0.43%	89
4	<a href="http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Oral_Ahopelto.pdf">http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Oral_Ahopelto.pdf</a>	140	0.45%	88
5	<a href="http://www.phantomsnet.net/ECSCD8/MetroMadrid.pdf">http://www.phantomsnet.net/ECSCD8/MetroMadrid.pdf</a>	119	0.38%	81
6	<a href="http://www.phantomsnet.net/files/newsletters/Newsletter_15_Preview.pdf">http://www.phantomsnet.net/files/newsletters/Newsletter_15_Preview.pdf</a>	2,670	8.60%	81
7	<a href="http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Binh.pdf">http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Binh.pdf</a>	101	0.32%	81
8	<a href="http://www.phantomsnet.net/TNT04/AuthorGuidelinesTNT04.pdf">http://www.phantomsnet.net/TNT04/AuthorGuidelinesTNT04.pdf</a>	231	0.74%	78
9	<a href="http://www.phantomsnet.net/NIT/Contents.pdf">http://www.phantomsnet.net/NIT/Contents.pdf</a>	128	0.41%	76
10	<a href="http://www.phantomsnet.net/TNT04/abstracts/keynotes/Abstract_Keynote_Guo.pdf">http://www.phantomsnet.net/TNT04/abstracts/keynotes/Abstract_Keynote_Guo.pdf</a>	232	0.74%	75
11	<a href="http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Arakawa.pdf">http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Arakawa.pdf</a>	110	0.35%	74
12	<a href="http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Duerig.pdf">http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Duerig.pdf</a>	97	0.31%	72
13	<a href="http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Poster_Docter.pdf">http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Poster_Docter.pdf</a>	99	0.31%	72
14	<a href="http://www.phantomsnet.net/LITHO/abstracts/posters/LITHO_poster_SarraffH.pdf">http://www.phantomsnet.net/LITHO/abstracts/posters/LITHO_poster_SarraffH.pdf</a>	120	0.38%	69
15	<a href="http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Deleonibus3.pdf">http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Deleonibus3.pdf</a>	116	0.37%	69
16	<a href="http://www.phantomsnet.net/TNT04/abstracts/orals/Abstract_Oral_RienerChristianK.pdf">http://www.phantomsnet.net/TNT04/abstracts/orals/Abstract_Oral_RienerChristianK.pdf</a>	95	0.30%	67
17	<a href="http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Poster_PhantomsGrant_vanBrugge n.pdf">http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Poster_PhantomsGrant_vanBrugge n.pdf</a>	125	0.40%	67
18	<a href="http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Avouris.pdf">http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Avouris.pdf</a>	75	0.24%	65
19	<a href="http://www.phantomsnet.net/TNT04/abstracts/orals/Abstract_Oral_HuskensJurriaan.pdf">http://www.phantomsnet.net/TNT04/abstracts/orals/Abstract_Oral_HuskensJurriaan.pdf</a>	110	0.35%	65
20	<a href="http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Oral_Mills.pdf">http://www.phantomsnet.net/files/abstracts/TNT2003/Abstract_Oral_Mills.pdf</a>	78	0.25%	65
<b>Total For the Files Above</b>		<b>5,326</b>	<b>17.16%</b>	<b>N/A</b>

## WP9: Networking Activities

**Partial financial support to Nanotechnology Workshops & Summer Schools** (grants for travelling and subsistence – mainly for students).

This partial funding provided by the network opened these workshops to all PHANTOMS nodes, especially at the graduate student level, and therefore enhance the exchange of knowledge and results.

Partial support (grants for travelling and subsistence) were given by the Management Board on a competitive basis to workshops satisfying a priori the following conditions:

- The field covered by the workshop should fall within at least one of the strategic research domains defined by PHANTOMS (see above).
- At least, one PHANTOMS member should be involved in the organising or steering committee of the meeting.
- Requested funding should be spent mainly in grants for students.
- The workshop should take place preferentially in Europe or in an associated country.

- 1) International Workshop on the Science and Application of Nanotubes (**NT01**) – Germany
- 2) Summer School on Nanotechnology – Wuerzburg (Germany) Trends in Nanotechnology Conference (**TNT2001**) – Spain
- 4) International Workshop on NanoImprint Lithography (**NIL**) – Sweden Summer School on Molecular Electronics – Spain
- 6) 6th International Ph.D. Summer School, "FRONTIERS IN NANO-SCIENCE AND NANOTECHNOLOGY" – Denmark Micro- and Nanoengineering 2002 (**MNE2002**) – Switzerland
- 8) Trends in Nanotechnology (**TNT2002**) – Spain
- 9) **Nano7/Ecoss21** International Conference – Sweden
- 10) 2002 Gordon Research Conference "Chemistry and Physics of Nanofabrication – USA
- 11) Nano and Giga Conference: "Software Development for Process and Materials Design" symposium – Russia
- 12) International Workshop on Computational Electronics (**IWCE9**) – Italy
- 13) 3rd Ibero American Workshop on Nanostructures for Application to Micro and Optoelectronics (**NANO2003**) – Spain **SpintechII** conference - Semiconductor Spintronics and Quantum Information Technology – Belgium Trends in Nanoechnology (**TNT2003**) – Spain
- 16) "International Workshop on Computational Electronics" (**IWCE-9**) - Italy
- 17) 18<sup>th</sup> International Winterschool on Electronics Properties of Novel Materials Molecular Nanostructures (**IWEPNM2004**) - Austria
- 18) "Ultimate Lithography and Nanodevice Engineering" International Conference (**LITHO2004**) - France
- 19) "Trends in Nanotechnology" (**TNT2004**) - Spain
- 20) "International Ph. D. Summer School on Molecular Nanotechnology" - Denmark
- 21) "Second conference on Microelectronics Microsystems and Nanotechnology" (**MMN2004**) - Greece

In total 21 grants were allowed to support Nanoelectronics events (mainly in Europe – 90%), out of which 4 were for Summer/Winter schools (training activities).

Country	Nº of funded events
Austria	1
Belgium	1
Denmark	2
France	1
Germany	2
Greece	1
Russia	1
Spain	6
Sweden	2
Switzerland	1
USA	1
<b>TOTAL</b>	<b>21</b>

## **WP10: Network Management**

The Network administrative team & the Management Board were responsible during the reporting period for:

- Management and follow-up of the Network budget
- Preparation of the Phantoms Network events (Industrial Day)
- Data search (and processing) for the PHANTOMS WEB site (<http://www.phantomsnet.net>).
- Promotion of the Network (WEB site, Booklet, flyers, conferences, etc.)
- Promote industrial participation in the Network activities
- Keep strong interactions with local, existing national networks in order to disseminate information efficiently
- Collect and process information in order to prepare “Phantoms Focused Reports”
- Provide technical support to NID Workshops organisation
- Guide and monitor the overall strategy of the Network
- Maintain a continuous link with the European Commission through its representative
- Decide on the allocation of funds within the Network (grants, support to Workshops, etc.).
- Search and decide on the possible new members of the Network
- Improve the mode of operation of the Network
- Produce newsletters on the PHANTOMS activities
- Facilitate discussions and act as a link between the (FET\*-NID) projects (develop ways to enhance the synergy between cross-disciplinary projects).
- Develop initiatives to retain qualified young scientists and engineers within Europe in the area of nanoelectronics by taking them aware of job opportunities, grants, etc.
- Identify new emerging areas related to Nanoelectronics

### **Current members of the Management Board (8):**

*Jean-Charles Guibert* (LETI/CEA - France)

*Massimo Macucci* (Pisa University - Italy)

*Jean-Noël Patillon* (Motorola - France)

*Clivia Sotomayor Torres* (UCC-NMRC - Ireland)

*Jürgen Brugger* (Institute of Microsystems (EPFL) - Switzerland)

*Chris Wilkinson* (University of Glasgow. Dept of Electronics and Electrical Engineering - UK)

*Antonio Correia* (PHANTOMS Foundation - Spain) - Coordinator

*Patrick Van-Hove* (EU-Belgium) - Project Officer

### **Former members of the Management Board (2):**

*Laurens Molenkamp* (Wuerzburg University - Germany)

*Ramon Compañó* (JRC Sevilla - Spain)

---

\* Future and Emerging Technologies

In order to maintain continuity and legitimacy in its activities, the PHANTOMS network renewed part of its Management Board members during the network lifetime. In 2002 and 2003 respectively, Prof. Laurens Molenkamp and Dr. Ramon Compañó resigned.

Election of 2 new members (among 4 candidates) has been carried on by PHANTOMS members.

### "PHANTOMS MB members" Election

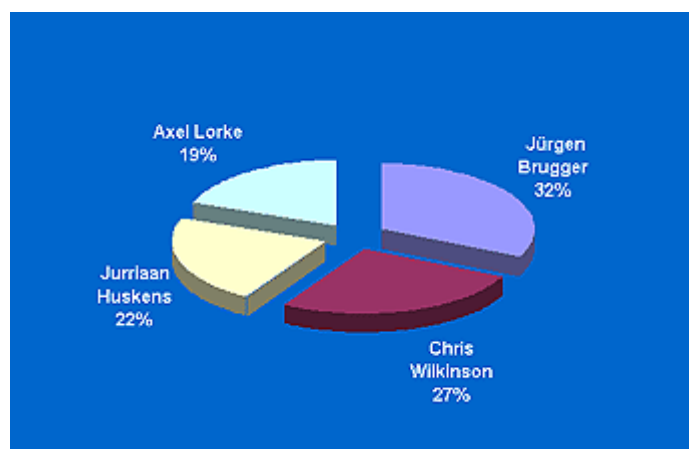
Final results / Number of members who voted: 59

Jurgen Brugger: 173 votes (elected)

Chris Wilkinson: 145 votes (elected)

Jurriaan Huskens: 121 votes

Axel Lorke: 104 votes



## Deliverables and references

### References

#### Phantoms Contributions in Conferences (21)

- Invited Contribution – Symposium on Micro-Nanotechnologies (Spanish Science Week – “Semana de la Ciencia”) (Vitoria, Spain) – November 8-14, 2004
- Invited Contribution – Nanotechnology Summer School (Aranjuez, Spain) – July 2004
- Invited Contribution – Nanotechnology Seminar (organised by CIDETEC) (San Sebastian, Spain) – June 28, 2004
- Oral Contribution at the 13<sup>th</sup> NID Workshop (Athens, Greece) – February 04-06, 2004
- Invited talk at the "3rd Meeting of the "Nanociencia" Spanish Network, Oviedo, Spain (26-28 November, 2003)
- Invited talk at the IV Congreso de la Sociedad Venezolana de Física, Isla Margarita (24-28 November, 2003)
- Invited talk at the "Mesa Redonda sobre Nanotecnología", Centro Español de Metrología (CEM), Madrid, Spain (05 November, 2003)
- Invited talk at the Forum "Nanotechnology and Nanoscience", Universidad Internacional Menéndez pelayo (UIMP), Valencia, Spain (13-17 October, 2003)
- Oral Contribution at the IST2003 Conference (Networking Session), Milan, Italy (03 October, 2003)
- Invited talk at “NanoTrends”, Cologne, Germany (June 30 – July 02, 2003)
- Invited talk at the ICFPAM 7, Bucharest, Romania (10-15 June 2003)
- Oral contribution at the IWCE-9 Conference, Rome (Italy), presented by Massimo Macucci

- Invited presentation at the "Nano2003" Conference, Madrid (Spain): March 24-28, 2003
- Invited presentation at the "Nanotech2003 + Future" Conference, Tokyo (Japan): February 26-28, 2003
- Invited presentation at the workshop "Initiatives européennes en nanosciences pour construire l'Espace Européen de la Recherche: réseaux d'excellence, projets intégrés, et centres scientifiques": Grenoble (France), December 16, 2002
- Invited presentation at the "NEXUS Forum", Brussels (Belgium): November 21-22, 2002
- Invited presentation at the "International Semiconductor Conference" (CAS2002), Sinaia (Romania): October 08-12, 2002
- Invited presentation at the "Extended panel session on Networks & Research Centers across Europe" (Marcus Evans Nanotechnology workshop), London (UK): June 13-14, 2002.
- Invited presentation at the 1st "NanoCiencia Network" Workshop, Madrid (Spain): April 25-26, 2002.
- Oral contribution at the Trends in Nanotechnology Conference (TNT2001), Segovia (Spain): September 03-07, 2001.
- Invited Talk at the Donostia International Physics Center (DIPC), San-Sebastian (Spain): May 25, 2001.

#### **Exhibition Stands at Conferences (1)**

- Exhibition Stand at RMNT Workshop 2004 (Cassis, France) – October 2004

#### **Phantoms Contributions in Scientific Journals (4)**

- "Nanobiotechnology and the Phantoms Network", Applied NanoScience, Vol.1, n°1, 2004 (page 13).
- "Phantoms Network: Nanotechnology Research Mapping – An Integrating Effect", "Nonlinear Optics, Quantum Optics" (NATO ARW), Vol.30, n°3-4, 2003 (page 181).
- "PHANTOMS: Nanotechnology Network for Information Processing and Storage", Nanotechnology 12 (2001) 89
- "PHANTOMS: Nanotechnology Network for Information Processing and Storage", Phantoms Newsletter 1, (2001) 2.

## Deliverables

### DELIVERABLES TABLE

**Project Number: IST-2000-26021**

**Project Acronym: PHANTOMS**

**Title: Network of Excellence in Nanoelectronics**

Del. No.	Revision	Title	Type <sup>1</sup>	Classifi- cation <sup>2</sup>	Due Date	Issue Date
D2		Focused Phantoms Report (SPM)	Other	Pub.		09/2003
		Focused Phantoms Report (Member Highlights)	Other	Pub.		
		Focused Phantoms Report (RANNS)	Other	Pub.	30/11/2004	30/11/2004
D3		Progress Report 1 (month 3)	Other	Int	28/02/2001	28/02/2001
D4		Progress Report 2 (month 6)	Other	Int	31/05/2001	31/05/2001
D5		Progress Report 3 (month 12)	Other	Int	30/11/2001	30/11/2001
D6		Progress Report 4 (month 18)	Other	Int	31/05/2002	31/05/2002
D7		Progress Report 5 (month 24)	Other	Int	30/11/2002	30/11/2002
D8		Progress Report 6 (month 30)	Other	Int	31/05/2003	31/05/2003
D9		Progress Report 7 (month 36)	Other	Int	30/11/2003	30/11/2003
D10		Progress Report 8 (month 42)	Other	Int	31/05/2004	31/05/2004
D11		Progress Report 9 (month 48)	Other	Int	30/11/2004	31/01/2005
D12		Final Report	Other	Int	30/11/2004	31/01/2005

<sup>1</sup> *R: Report; D: Demonstrator; S: Software; W: Workshop; O: Other – Specify in footnote*

<sup>2</sup> *Int.: Internal circulation within project (and Commission Project Officer + reviewers if requested)*

*Rest.: Restricted circulation list (specify in footnote) and Commission SO + reviewers only*

*IST: Circulation within IST Programme participants*

*FP5: Circulation within Framework Programme participants*

*Pub.: Public document*

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**  
Project Acronym: **PHANTOMS**  
Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D2**  
Due date:  
Delivery Date: **Sept. 03**

Short Description:  
The Phantoms report on SPM (Basic concepts and applications) aims providing:  
\*A practical approach to Scanning Probe Microscopy (SPM)  
\*A guide for a new SPM user  
\*A reference manual in Laboratories

Partners owning: **PHANTOMS Foundation**

Partners contributed:

Made available to: **Public**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**  
Project Acronym: **PHANTOMS**  
Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D2**  
Due date:  
Delivery Date: **2004**

### Short Description:

Within the aim to provide detailed information on groups involved in nanoelectronics research, an extended report including "Members Highlights" description of all PHANTOMS members has been sent to the Phantoms members and distributed in several high-level conferences. This information is particularly important considering the future call for proposals within the IST VI & VII Framework Programmes to be launched by the European Commission. Therefore there is a strong need for partners searching to form research consortia (IP, NoE, etc.).

This report has been edited in CD-Rom format.

Partners owning: **PHANTOMS Foundation**

Partners contributed:

Made available to: **Public**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**  
Project Acronym: **PHANTOMS**  
Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D2**  
Due date:  
Delivery Date: **Nov. 04**

### Short Description:

The fourth "Focused Phantoms Report" (RANNS) was delivered in November 2004 (CD-Rom format) and will be published in 2005 and sent to all PHANTOMS members. A copy of the report will also be available in the WEB site (<http://www.phantomsnet.net>) – Restricted Area  
The report includes summaries of work in progress in the following areas:

- \*Existing and proposed devices*
- \*Small and ultra-large circuits: theory and practice*
- \*Conventional architectural concepts - 'System on a chip', 3D systems et cetera.*
- \*Known problems*
- \*Unconventional and new concepts*
- \*Applications – performance requirements*
- \*Availability and training of human resources*

Partners owning: **PHANTOMS Foundation**

Partners contributed:

Made available to: **Public**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**  
Project Acronym: **PHANTOMS**  
Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D3**  
Due date: **28/02/2001**  
Delivery Date: **28/02/2001**

### Short Description:

The Interim Report provides an overview of the work carried out during the reporting period for the PHANTOMS network contract - first 3 months (December 2000 – February 2001).

Partners owning: **CMP Cientifica S.L.**

Partners contributed:

Made available to: **Int**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**  
Project Acronym: **PHANTOMS**  
Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D4**  
Due date: **31/05/2001**  
Delivery Date: **31/05/2001**

### Short Description:

The Periodic Progress Report (PPR) provides an overview of the work carried out during the reporting period for the PHANTOMS network contract (December 2000 – May 2001).

Partners owning: **CMP Cientifica S.L.**

Partners contributed:

Made available to: **Int**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**  
Project Acronym: **PHANTOMS**  
Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D5**  
Due date: **30/11/01**  
Delivery Date: **30/11/01**

### Short Description:

The Periodic Progress Report (PPR) provides an overview of the work carried out during the reporting period for the PHANTOMS network contract (June 2001 – November 2001).

Partners owning: **CMP Cientifica S.L.**

Partners contributed:

Made available to: **Int**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**  
Project Acronym: **PHANTOMS**  
Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D6**  
Due date: **31/05/2002**  
Delivery Date: **31/05/2002**

### Short Description:

The Periodic Progress Report (PPR) provides an overview of the work carried out during the reporting period for the PHANTOMS network contract (December 2001 – May 2002).

Partners owning: **CMP Cientifica S.L.**

Partners contributed:

Made available to: **Int**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**  
Project Acronym: **PHANTOMS**  
Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D7**  
Due date: **30/11/02**  
Delivery Date: **30/11/02**

### Short Description:

The Periodic Progress Report (PPR) provides an overview of the work carried out during the reporting period for the PHANTOMS network contract (June 2002 – November 2002).

Partners owning: **CMP Cientifica S.L.**

Partners contributed:

Made available to: **Int**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**  
Project Acronym: **PHANTOMS**  
Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D8**  
Due date: **31/05/2003**  
Delivery Date: **31/05/2003**

### Short Description:

The Periodic Progress Report (PPR) provides an overview of the work carried out during the reporting period for the PHANTOMS network contract (December 2002 – May 2003).

Partners owning: **CMP Cientifica S.L.**

Partners contributed:

Made available to: **Int**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**  
Project Acronym: **PHANTOMS**  
Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D9**  
Due date: **30/11/03**  
Delivery Date: **30/11/03**

### Short Description:

The Periodic Progress Report (PPR) provides an overview of the work carried out during the reporting period for the PHANTOMS network contract (June 2003 – November 2003).

Partners owning: **CMP Cientifica S.L.**

Partners contributed: **PHANTOMS Foundation**

Made available to: **Int**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**

Project Acronym: **PHANTOMS**

Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D10**

Due date: **31/05/2004**

Delivery Date: **31/05/2004**

Short Description:

The Periodic Progress Report (PPR) provides an overview of the work carried out during the reporting period for the PHANTOMS network contract (December 2003 – May 2004).

Partners owning: **CMP Scientifica S.L.**

Partners contributed: **PHANTOMS Foundation**

Made available to: **Int**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**  
Project Acronym: **PHANTOMS**  
Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D11**  
Due date: **30/11/04**  
Delivery Date: **31/01/05**

### Short Description:

The Periodic Progress Report (PPR) provides an overview of the work carried out during the reporting period for the PHANTOMS network contract (June 2004 – November 2004).

Partners owning: **CMP Cientifica S.L.**

Partners contributed: **PHANTOMS Foundation**

Made available to: **Int**

## DELIVERABLE SUMMARY SHEET

Project Number: **IST-2000-26021**

Project Acronym: **PHANTOMS**

Title: **Network of Excellence in Nanoelectronics**

Deliverable N°: **D12**

Due date: **30/11/04**

Delivery Date: **31/01/05**

Short Description:

The Final Report provides an overview of the work carried out during the full Phantoms contract duration.

Partners owning: **CMP Cientifica S.L.**

Partners contributed: **PHANTOMS Foundation**

Made available to: **Int**

## **Potential Impact of project results**

## Project's Achievements Fiche

Questions about project's outcomes	Number	Comments
<b>1. Scientific and technological achievements of the project (and why are they so?)</b>		
<u>Question 1.1.</u> Which is the 'Breakthrough' or 'real' innovation achieved in the considered period	N/A	Brief description:
<b>2. Impact on Science and Technology: Scientific Publications in scientific magazines</b>		
<u>Question 2.1.</u> Scientific or technical publications on reviewed journals and conferences	0	Title and journals/conference and partners involved
<u>Question 2.2.</u> Scientific or technical publications on non-reviewed journals and conferences	1	Title and journals/conference and partners involved <ul style="list-style-type: none"> <li>• "PHANTOMS: Nanotechnology Network for Information Processing and Storage", Phantoms Newsletter 1, (2001) 2.</li> </ul>
<u>Question 2.3.</u> Invited papers published in scientific or technical journal or conference.	3	Title and journals/conference and partners involved <ul style="list-style-type: none"> <li>• "Nanobiotechnology and the Phantoms Network", Applied NanoScience, Vol.1, n°1, 2004 (page 13).</li> <li>• "Phantoms Network: Nanotechnology Research Mapping – An Integrating Effect", "Nonlinear Optics, Quantum Optics" (NATO ARW), Vol.30, n°3-4, 2003 (page 181).</li> <li>• "PHANTOMS: Nanotechnology Network for Information Processing and Storage", Nanotechnology 12 (2001) 89</li> </ul>
<b>3. Impact on Innovation and Micro-economy</b>		
<b>A - Patents</b>		
<u>Question 3.1.</u>		When and in which country(ies):

Patents filed and pending	0	Brief explanation of the field covered by the patent:
<u>Question 3.2.</u> Patents awarded	0	When and in which country(ies): Brief explanation of the field covered by the patent* (if different from above):
<u>Question 3.3.</u> Patents sold	0	When and in which country(ies): Brief explanation of the field covered by the patent* (if different from above):
<b>Questions about project's outcomes</b>	<b>Number</b>	<b>Comments or suggestions for further investigation</b>
<b>B - Start-ups</b>		
<u>Question 3.4.</u> Creation of start-up	No	If YES, details: - date of creation: - company name - subject of activity: - location: - headcount: - turnover: - profitable : yes / no / when expected - web address:
<u>Question 3.5.</u> Creation of new department of research (ie: organisational change)	No	Name of department and institution/company:
<b>C – Technology transfer of project's results</b>		
<u>Question 3.6.</u> Collaboration/ partnership with a company ?	No	Which partner : Which company : What kind of collaboration ?
<b>4. Other effects</b>		
<b>A - Participation to Conferences/Symposium/Workshops or other dissemination events</b>		

<p><u>Question 4.1.</u></p> <p>Active participation<sup>1</sup> to Conferences in EU Member states, Candidate countries / NAS. (specify if one partner or "collaborative" between partners)</p>	<p>20</p>	<p>Names/ Dates/ Subject area / Country:</p> <ul style="list-style-type: none"> <li>• Invited Contribution – Symposium on Micro-Nanotechnologies (Spanish Science Week – “Semana de la Ciencia”) (Vitoria, Spain) – November 8-14, 2004</li> <li>• Invited Contribution – Nanotechnology Summer School (Aranjuez, Spain) – July 2004</li> <li>• Invited Contribution – Nanotechnology Seminar (organised by CIDETEC) (San Sebastian, Spain) – June 28, 2004</li> <li>• Oral Contribution at the 13<sup>th</sup> NID Workshop (Athens, Greece) – February 04-06, 2004</li> <li>• Invited talk at the "3rd Meeting of the "Nanociencia" Spanish Network, Oviedo, Spain (26-28 November, 2003)</li> <li>• Invited talk at the "Mesa Redonda sobre Nanotecnología", Centro Español de Metrología (CEM), Madrid, Spain (05 November, 2003)</li> <li>• Invited talk at the Forum "Nanotechnology and Nanoscience", Universidad Internacional Menéndez pelayo (UIMP), Valencia, Spain (13-17 October, 2003)</li> <li>• Oral Contribution at the IST2003 Conference (Networking Session), Milan, Italy (03 October, 2003)</li> <li>• Invited talk at "NanoTrends", Cologne, Germany (June 30 – July 02, 2003)</li> <li>• Invited talk at the ICFPAM 7, Bucharest, Romania (10-15 June 2003)</li> <li>• Oral contribution at the IWCE-9 Conference, Rome (Italy), presented by Massimo Macucci</li> <li>• Invited presentation at the "Nano2003" Conference, Madrid (Spain): March 24-28, 2003</li> <li>• Invited presentation at the workshop "Initiatives européennes en nanosciences pour construire l'Espace Européen de la Recherche: réseaux d'excellence, projets intégrés, et centres scientifiques": Grenoble (France), December 16, 2002</li> <li>• Invited presentation at the "NEXUS Forum", Brussels (Belgium): November 21-22, 2002</li> <li>• Invited presentation at the "International Semiconductor Conference" (CAS2002), Sinaia (Romania): October 08-12, 2002</li> <li>• Invited presentation at the "Extended panel session on Networks &amp; Research Centers across Europe" (Marcus Evans Nanotechnology workshop), London (UK): June 13-14, 2002.</li> <li>• Invited presentation at the 1st "NanoCiencia Network" Workshop, Madrid (Spain): April 25-26, 2002.</li> <li>• Oral contribution at the Trends in Nanotechnology Conference (TNT2001), Segovia (Spain): September 03-07, 2001.</li> </ul>
---	-----------	---

<sup>1</sup> 'Active Participation' in the means of organising a workshop / session / stand / exhibition directly related to the project (apart from events presented in section 2).

		<ul style="list-style-type: none"> <li>Invited Talk at the Donostia International Physics Center (DIPC), San-Sebastian (Spain): May 25, 2001.</li> <li>Exhibition Stand at RMNT Workshop 2004 (Cassis, France) – October 2004</li> </ul>
<u>Question 4.2.</u> Active participation to Conferences outside the above countries (specify if one partner or "collaborative" between partners)	2	Names/ Dates/ Subject area / Country: <ul style="list-style-type: none"> <li>Invited talk at the IV Congreso de la Sociedad Venezolana de Física, Isla Margarita (24-28 November, 2003)</li> <li>Invited presentation at the "Nanotech2003 + Future" Conference, Tokyo (Japan): February 26-28, 2003</li> </ul>
<b>B – Training effect</b>		
<u>Question 4.3.</u> Number of PhD students hired for project's completion	0	In what field :
<b>Questions about project's outcomes</b>	<b>Number</b>	<b>Comments or suggestions for further investigation</b>
<b>C - Public Visibility</b>		
<u>Question 4.4.</u> Media appearances and general publications (articles, press releases, etc.)	Yes	References: Since the beginning of the network, 4 articles were published in Scientific Journals and various press releases in WEB sites such as <a href="http://www.nanotechweb.org">http://www.nanotechweb.org</a> or <a href="http://www.nanotech-now.com">http://www.nanotech-now.com</a> . (Please attach relevant information)
<u>Question 4.5.</u> Web-pages created or other web-site links related to the project	Yes	References: <a href="http://www.phantomsnet.net">http://www.phantomsnet.net</a> Search in Google for "Phantoms network nanotechnology": about 5330 entries instead of 3400 and 1510 six and twelve months ago respectively. (Please attach relevant links)

<p><u>Question 4.6.</u></p> <p>Video produced or other dissemination material</p>	<p>Yes</p>	<p>References:</p> <p>Network flyer  Phantoms Newsletters (bi-monthly)  Phantoms Reports  Phantoms workshop proceedings  NID Workshop proceedings (six-monthly)  Industrial Day proceedings</p> <p>(Please attach relevant material)</p>
<p><u>Question 4.7.</u></p> <p>Key pictures of results</p>		<p>References:</p> <p>(Please attach relevant material .jpeg or .gif)</p>
<b>D - Spill-over effects</b>		
<p><u>Question 4.8.</u></p> <p>Any spill-over to national programs</p>	<p>Yes</p>	<p>If YES, which national programme(s):</p> <p>Spanish Nanotechnology Network (NanoSpain) – Spanish Ministry of Science</p>
<p><u>Question 4.9.</u></p> <p>Any spill-over to another part of EU IST Programme</p>	<p>Yes</p>	<p>If YES, which IST programme(s):</p> <p>NanoIndex Initiative (Nanotechnology Industry Exchanges) – IST project funded until December 2003</p>
<p><u>Question 4.10.</u></p> <p>Are other team(s) involved in the same type of research as the one in your project?</p>	<p>Yes / No</p>	<p>If YES, which organisation(s):</p>

## **Future Outlook**