

## 2008 Report of Nanoscience Working Group to IUPAP Council and General Assembly



IUPAP Nanoscience Working Group Meeting, Szeged, Hungary, 7 Sept. 2006

Back: A. Beye, W. van Wijngaarden, M. Tegze

Front: A. Hansen, M. Maaza, P. Ormos, D. Dahlberg, M. Paalanen, P. Hawrylak

Regrets: R. Slusher, R. Nieminen

Dear IUPAP Council and General Assembly Delegates

The Nanoscience Working Group (WG8) was established by IUPAP Council in October of 2004. It was given the mandate to determine how IUPAP could stimulate the development of Nanoscience. In particular, it was asked what steps could be taken to improve the coupling between the cold atom and the core nanoscience communities. The committee first met in April, 2005 and recommended IUPAP sponsor a series of meetings, each focusing on one area of nanoscience to improve the synergy between researchers in the various IUPAP commissions. The first meeting entitled Nanobiophysics was held Sept. 3-7, 2006 in Szeged, Hungary and a second, Ultracold NanoMatter took place Feb. 14-16, 2008 in Toronto, Canada. These meetings attracted the world's leading researchers. Attendance was deliberately kept at about 75 to facilitate informal discussions between researchers, students and postdocs. We would like to thank IUPAP for contributing seed money.

WG8 consists of 11 members that include representatives from NanoAfnet and the International Commission for Optics (Affiliated Commission AC.1). The terms of 4 members including the Chair are expiring this year. It is therefore timely for IUPAP Council to review our mandate. Members felt that the topic of a third meeting that could possibly be held in Asia in 2010, should be deferred to the incoming members of the Nanoscience Working Group in close consultation with the IUPAP Commission Chairs/General Assembly. Possibilities include: periodic metallic structures, microresonators, negative refractive index materials & photonic crystals. It may be desirable to involve chemists and also have more students/researchers from the developing world.

On behalf of the Nanoscience Working Group,

/

W. van Wijngaarden,

IUPAP

## Table of Contents

1. Working Group Mandate
2. Membership
3. Minutes of Past Meetings
  - a) Szeged, Hungary, 7 Sept. 2006
  - b) Toronto, Canada, 16 Feb. 2008
4. Conference Reports
  - a) Nanobiophysics, Szeged, Hungary 2006
  - b) Ultracold NanoMatter, Toronto, Canada 2008
5. NanoAfnet
6. International Commission for Optics (Affiliated Commission AC.1)

## **Mandate of IUPAP Nanoscience Working Group**

Nanoscience is a rapidly expanding field affecting a number of areas of physics. IUPAP Executive & Commission Chairs created Nanoscience Working Group at its October 2004 meeting. The Working Group is to examine connections between Nanoscience and other fields of physics to determine whether and how IUPAP can facilitate its development.

Particular objectives of the working group are the following:

1. Examine how nanoscience is fitting into established IUPAP sponsored conferences.
2. Are there any steps that could be taken to improve the coupling between the cold atom and the core nanoscience communities?
3. Address whether and how IUPAP can stimulate the development of nanoscience. For example, would a conference sponsored by multiple IUPAP commissions devoted solely to Nanoscience be desirable?

### Membership of Nanoscience Working Group

Commission	Member	Institution	Term
C3 Statistical Physics	A. Hansen	Trondheim, Norway	2006 — 09
C5 Low Temperature Physics	M. Paalanen	Helsinki University of Technology, Finland	2005 — 08
C6 Biological Physics	U. Nienhaus	Universiteit Ulm, Germany	2007 - 10
C8 Semiconductors	P. Hawrylak	National Research Council of Canada	2006 — 09
C9 Magnetism	D. Dahlberg	U. of Minnesota, USA	2006 — 09
C10 Condensed Matter	J. Gao	McMaster Univ., Canada	2006 - 09
C15 Atom. Mol. & Opt. Physics	W. van Wijngaarden (Chair)	York University, Canada	2005 - 08
C17 Quantum Electronics	R. Slusher	Lucent, USA	2001 - 08
C20 Computational Physics	R. Nieminen	Helsinki, Finland	2005 — 08
NANOAFNET	M. Maaza (Associate)	iThemba Labs, South Africa	2006 - 09
AC.I Optics	A. Guzman (Associate.)	Universidad Nacional Bogota, Colombia	2008 - 11

## Minutes of IUPAP Working Group 8: Nanoscience

Szeged, Hungary  
Sept. 7, 2006

**Present:** D. Dahlberg, A. Hansen (Secretary), P. Hawrylak, P. Ormos, M. Paalanen, M. Tegze, W. van Wijngaarden (Chair)

**Regrets:** R. Nieminen, R. Slusher

Guests: Representing NanoAfnet: A.C. Beye, M. Maaza

- 1. Approval of Minutes:** The minutes of the Paris meeting were approved unanimously. (See attachment 1)
- 2. Review of Mandate:** W. van Wijngaarden presented a review of the WG8 mandate and past deliberations (See attachment 2). The primary objective is to stimulate the development of nanoscience by bringing together researchers from the different areas of Physics as represented by the IUPAP commissions. The Working Group recommended that IUPAP sponsor small meetings that focus on one area of nanoscience as opposed to nanotechnology. These meetings should have an attendance of 50-100 researchers to facilitate new contacts between researchers of different physics backgrounds. At the Paris meeting the following three topics were discussed:
  - a) Nanobiophysics
  - b) Quantum degenerate matter
  - c) Nanoscale transport

The Working Group recommended that IUPAP sponsor a meeting on Nanobiophysics which was held in Szeged Sept 3 - 7, 2006. No decisions regarding whether or not to recommend the other two topics for a future meeting were made.

- 3. Report of Nanobiophysics Conference:** This meeting was organized by P. Ormos. He reported that about 75 people attended (See attachment 3). Several members of the Working Group had heard favourable comments about the meeting. A number of attendees did not have a background in biophysics but found this a useful meeting to help making the Nanobiophysics meeting a great success. **Action:** A report to IUPAP will be prepared by P. Ormos and W. van Wijngaarden.
- 4. Nano-African Information Network Initiative:** A. C. Beye and M. Maaze presented talks (see attachment 4) describing NANOAFNET. This body is coordinating research in 13 countries across the African continent. Members are both individuals and organizations. It offers at present 200 fellowships. There are 24 Ph.D. students working under the program. The vision is to double this number each year except in South Africa where the number already is high. The network has as an explicit goal to improve working conditions in Africa to attract African researchers studying in Europe, Asia and North America back home. This can only be accomplished by improving the research atmosphere i.e. *capacity building*. IUPAP can assist NanoAfnet by:
  - a) providing moral support
  - b) help provide access to electronic journals
  - c) possibly providing awards for students and faculty

3b

### Minutes of IUPAP Working Group 8: Nanoscience

**Point a:** IUPAP should be involved with conferences organized by NanoAfnet.

**Point b:** It is difficult for IUPAP to be helpful with respect to journal access. The UN might be helpful in this regard as well as publishing non-profit or, anLatiu.is such as the APS.

**Point c:** The question of joint awards needs to be posed directly to IUPAP Council.

Everyone believed that communication is important and that a representative of NanoAfnet should be an Associate member of the Working Group.

**Action:** Ask IUPAP Council to approve M. Maaza as an Associate Member of the Nanoscience Working Group.

5. **Nanostandardization (SUNAMCO):** The presentation by L. Pendrill, chair of IUPAP's SUNAMCO Commission, was presented (See attachment 5). He was invited to attend this meeting but could not. **Action:** Request that IUPAP Council approve M. Paalanen as liaison between SUNAMCO and our Working Group.
6. **Commission Reports:** The commission members presented status of their various IUPAP commissions pertaining to Nanoscience (See attachments 6-14).
7. **Recommendation for Future Conference:** It was unanimously decided that IUPAP should sponsor a second meeting in Nanoscience as follows.

Tentative Topic:	Quantum Degenerate Matter.
Tentative Time:	February 2008
Place:	Canada (Banff, Quebec City, Toronto or Vancouver)

The organizing committee will consist of the following.

- A. Hansen (C3 – Statistical Physics)
- M. Paalanen (C5 – Low Temperature Phys.)
- Representative of CIO (Condensed Matter)
- W. van Wijngaarden (C 15- Atom., Mol, Opt. Phys.) – Chair
- P. Hawrylak (C8 – Semiconductors)
- D. :lush,: (C17 –
- R. Nieminen (C20 – Computational Physics)

**Action:** W. van Wijngaarden will submit a formal proposal for IUPAP Council. A request of \$10,000 to support the meeting was unanimously endorsed.

8. **Terms of Working Group Members:** W. van Wijngaarden reported that IUPAP Council would like members to have staggered 3 year terms. It would also be useful to have a Vice Chair but no one volunteered. Several individuals indicated they were substituting for someone else and would only be willing to be a member of the Working Group if their Commission formally approved. **Action:** W. van Wijngaarden will contact those members to check if they wish to continue serving on the Working Group.
9. **Adjournment:** The meeting ended at 7:15 for a working dinner 8:00 – 10:00 pm.

## Minutes of IUPAP Working Group 8: Nanoscience

Toronto, Canada

Feb. 16, 2008

**Present:** A. Guzman, P. Hawrylak, M. Paalanen, R. Slusher, W. van Wijngaarden (Chair), K. von Klitzing,

**Regrets:** D. Dahlberg, B. Gaulin, A. Hansen, M. Maaza, R. Nieminen, U. Nienhaus

1. **Approval of Minutes:** The minutes of the Szeged meeting were circulated. These had previously been approved unanimously via email.
2. **Welcome of A. Guzman:** W. van Wijngaarden welcome A. Guzman who was unanimously approved as an associate member of our Working Group. She represents the Associated Commission on Optics.
3. **Report of Ultracold NanoMatter Conference:** W. van Wijngaarden led the organization of this meeting and presented a report (Attachment 1 and Conference Program Attachment 7). The meeting featured 20 excellent invited speakers and 30 poster presentations. There was considerable interaction among the attendees, during meals and especially at the Thursday evening poster session which was very well attended right until closing time. The meeting attracted a wide range of researchers from many countries with over 85% coming from outside Toronto.

M. Paalanen suggested trying to quantify the attendance by discipline of the various IUPAP Commissions. This is difficult to do *as many* researchers can be considered as represented by multiple commissions. However, there were over a dozen researchers from each of the following IUPAP Commissions: C5 Low Temperature Physics, C8 Semiconductors, C 10 Condensed Matter, C 15 Atomic, Molecular & Optical Physics and C17 Quantum Electronics.

4. **Commission Reports:** Reports from M. Maaza (Nanoafnet), R. Nieminen (Computational Physics) and U. Nienhaus (Biological Physics) were circulated (See attachments 2-4).

A. Guzman noted the great interest that the worldwide optics community has in nanoscience, the fact that optics will be a very useful tool in the analysis of material properties and in the study of new phenomena arising from light-matter interactions in new nanostructured and composite materials. She emphasized the highly multidisciplinary character of optics and the importance of establishing better communication between researchers in optics and those in all areas of physics represented in this group. She also expressed an interest in promoting a Nanoscience Organization in Latin America similar to Nanoafnet. Helping physicists in the developing world is a high priority of IUPAP, and IUPAP would undoubtedly be helpful to any similar network in Latin America. It was suggested that A. Guzman contact M. Maaza. The issue of free electronic access to physics journals for physicists in the developing world was discussed. R. Slusher said that APS has reduced prices for the developing world and ongoing discussions about how to further assistance are underway

with publishers. Another way to help the developing world would be to increase exchange/visits to laboratories in Europe, North American and Japan. The ongoing work of Trieste in sponsoring nanoscience workshops for developing world scientists was also noted.

Nanoscience remains a prominent feature at the main conferences sponsored by the various IUPAP commissions. M. Paalanen noted that some of the candidates for the IUPAP young investigator prize are in low temperature nanoscience. About 20% of the program of the Low Temperature Conference in Amsterdam is also nanoscience.

P. Hawrylak and K. von Klitzing noted that 80% of all semiconductors conference presentations are nanoscience. This is evident at meetings such as the Quantum Dot Conference in Korea and the ICPS meeting in Rio de Janeiro. K. von Klitzing also noted the creation of the Kavli Nanoscience Prize which will consists of 3 prizes of up to \$1 million.

5. **Presentation by A. Guzman (Associated Commission on Optics):** A. Guzman gave a very nice presentation (See attachment 5) describing the work of the Associated Commission on Optics. Among the interesting activities of this commission are those supporting Education and Training on Optics, which includes the contribution of the Member Societies of the Commission, in particular that of the Optical Society of America, in the creation of optics websites targeting children and teenagers. Improved linkages between the websites of IUPAP and the Associated Commission on optics are desirable. A. Guzman will arrange for the members of the working group to receive the Optics Commission newsletter.
6. **Recommendation to IUPAP regarding Future Meetings:** The first meeting sponsored by the Nanoscience Working Group on NanoBiophysics was held in Europe in 2006 while the Ultracold NanoMatter meeting took place in North America. Asia may therefore be the logical place for a third meeting in 2010. Possible locations include China, Hong Kong, India, Japan, Korea, Taiwan & Singapore. The committee members felt that the conference topic should be deferred to the incoming members of the Nanoscience Working Group in close consultation with the IUPAP Commission Chairs/General Assembly. However, a number of suggestions were discussed including: periodic metallic structures, microresonators, negative refractive index materials & It \_\_\_\_, t\_ . \_ in EtLi a  
Greater participation of students/researchers from the developing world would also be desirable and perhaps the IUPAP Commission on Development & Education could help with that. **Action: The IUPAP Commission Chairs/General Assembly will need to decide the topic and location of the next meeting. It should be emphasized that a strong local organizer is essential for the success of such a meeting.**
7. **Membership Terms of Working Group:** Attachment 6 shows several members of the Working Group are completing their terms. Several including M. Paalanen and R. Slusher have served 9 years on their commissions and are ineligible for reelection. **Action: IUPAP Commissions will need to replace retiring Nanoscience Working Group Members.**
8. **Adjournment:** The meeting ended at 3:30.

## **Report on the Nanobiophysics Conference**

Biological Research Centre, Szeged, Hungary, Sept. 3-7, 2006

The Conference of Nanobiophysics was organized in Szeged, Hungary, September 3 – 7, 2006. The Conference was the first in a planned series of conferences sponsored by IUPAP in the area of nanoscience.

As it has been discussed during the first meeting of the Nanoscience Working Group, the definition or content of "nanoscience" is not at all obvious, and in different fields they may cover significantly different areas. The choice of the field of the first conference was made on the basis of the fact that in biology the natural size is nanometers, making it an obvious selection.

In the organization of the conference we had to take into account that in the field of biological physics there have already been a number of conferences that belong to the "nano" concept. These are primarily related to single molecule and single particle manipulation studies that represent by today a fairly well characterized set of fields and scientists. Consequently, we tried to include topics and experts from a broader area –even though the meeting was relatively small. The topics covered experimental methods used in nanobiophysics, interesting nanoscale biostructures, modelling, and included areas like magnetic subcellular nanostructures, membrane structures, membrane model systems for biological studies as well as sensoric applications. I emphasize that in most cases truly outstanding experts of the respective topics have participated, the list of lecturers in most impressive. Participants came from Hungary, Japan, Germany, Italy, France, Israel, USA, Sweden, Denmark, Czech Republic, Serbia, Switzerland, Romania, UK. The detailed program including the authors and abstracts is appended.

The participation statistics was the following:

Participants: 73

Foreign: 28

Hungarian: 45

Lectures: 30 (21 invited)

Foreign: 19

H u n g a r i a n : 1 1

Posters: 27 (with abstract: 5)

Due to the generous support by IUPAP (10.000 US\$), and additional support by NKTH (the Hungarian R&D financing agency: 6.000 US\$) the conference could be organized such that in addition to the cost of the organization itself, a significant cost of the participants could be covered.

All local costs of the invited speakers were covered, with travel support to 4 who applied for it. In addition, thanks to the additional Hungarian support the registration fee (that covered meals and social programs) was waived to all participants.

In the end, a most successful meeting has been organized. A number of participants expressed their opinion that the selection of topics was fortunate and made it a most informative and enjoyable meeting.

Szeged, September 1<sup>st</sup>,

Pal Ormos

## **Ultracold NanoMatter Report**

W. A. van Wijngaarden

Feb. 16, 2008

The meeting took place at Black Creek Pioneer village located next to York University in Toronto Canada. The meeting began Thursday morning Feb. 14 and ended Saturday afternoon Feb. 16. It featured 20 invited speakers and 30 poster presentations. Nearly 1/3 of the participants were graduate students. Attendance is estimated to be close to 80 with the majority being from outside Canada. Institutions along with countries represented were as follows.

### **Austria**

University of Innsbruck

### **Canada**

McMaster University National  
Research Council Trent University  
University of British Columbia  
University of Calgary  
University of Toronto  
University of Waterloo  
University of Windsor York  
University

### **Colombia**

National University Bogota

### **Finland**

Helsinki University of Technology

### **France**

CNRS - Grenoble  
Ecole Normale Superieure

### **Germany**

Max Planck Institut for Condensed Matter – Stuttgart  
Max Planck Institut for Quantum Optics – Garching  
University of Heidelberg

### **Japan**

University of Tokyo  
Kyoto University  
Waseda University

### **Netherlands**

Free University Amsterdam

### **United Kingdom**

Cambridge University  
Lancaster University  
University College, London

### **USA**

Cornell University  
Georgia Tech.  
Harvard University  
Rice University  
University of Texas  
MIT

# Ultracold NanoMatter

- Electronic Nanostructures in Quantum Materials
- Semiconductor Nanostructures
- Ultracold Refrigeration & Thermometry
- Bose Einstein Condensation & Degenerate Fermi Gases
- Quantum Information Processing & Simulation

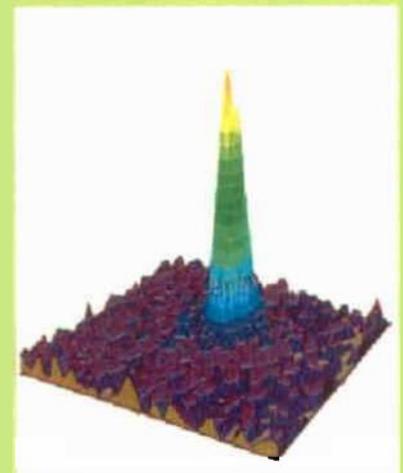
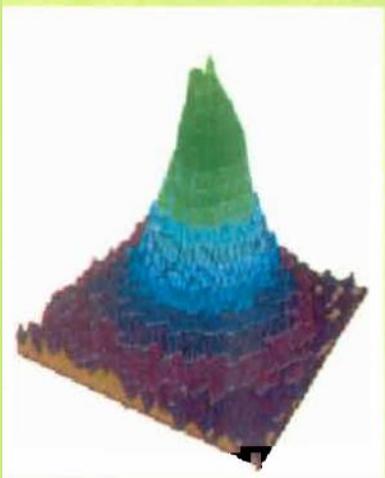
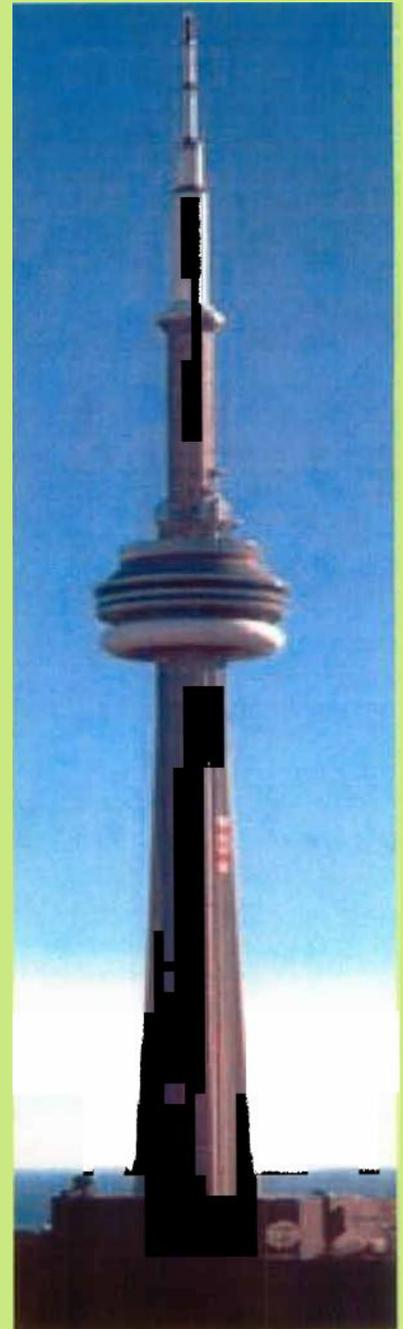
14 - 16 February 2008

Toronto, Canada

[www.yorku.ca/ucn2008](http://www.yorku.ca/ucn2008)



YORK•I



Dear Ultracold NanoMatter Attendee:

On behalf of the International Union of Pure and Applied Physics (IUPAP), it is a pleasure to welcome you to Toronto. Nanoscience is a rapidly growing field of research. IUPAP therefore decided three years ago to set up a working group on this topic. This meeting is the second in a series of small conferences whose purpose is to bring together researchers whose paths do not ordinarily cross. The first meeting on Bionanoscience was held in Szeged, Hungary, in September, 2006. Each meeting is limited to about 5075 individuals to facilitate informal exchange amongst the participants.

We would like to thank IUPAP for its generous financial support and also that of our other sponsors, York University, the National Research Council of Canada and the Brockhouse Institute of Materials Sciences. York is Canada's third largest university having over 40,000 students. Science and Engineering is a rapidly growing faculty at York. The Physics department has 25 faculty and over 40 graduate students. We would welcome the opportunity to show you our laboratories.

Toronto is one of Canada's most dynamic cities. It is growing rapidly, with over half of all immigrants to Canada settling in its metropolitan area. Indeed, over half of Toronto's residents were born outside Canada. There are a number of attractions in the area including the CN Tower, the Ontario Science Center, the provincial parliament buildings at Queen's Park as well as numerous restaurants and theaters downtown. Further afield, we are within two hours drive from Niagara Falls, the Shaw Theater at Niagara on the Lake and the Shakespeare Theater in Stratford, Ontario.

Thank you for coming to Toronto. We hope you have an enjoyable and productive meeting.

Sincerely,



1A

a r k t i c —

William van Wijngaarden  
Chair of Organizing Committee  
Physics Dept., York University  
Tel: 416-736-2100 Ext. 77750  
[Email: wavw@yorku.ca](mailto:wavw@yorku.ca)

**Membership of IUPAP Nanoscience Working Group  
(Conference Organizing Committee)**

IUPAP Commission	Representative	institution
C3 Statistical Physics	Alex Hansen	Norwegian University of Science & Technology Trondheim, Norway
C5 Low Temperature Physics	Mikko Paalanen	Helsinki University of Technology (TKK), Finland
C6 Biological Physics	Uli Nienhaus	Universität Ulm, Ulm, Germany
C8 Semiconductors	Pavel Hawrylak	National Research Council, Ottawa, Canada
C9 Magnetism	Dan Dahlberg	Magnetic Microscopy Center U. of Minnesota, USA
C10 Condensed Matter	Leif Clauser	McMaster University, Hamilton, Canada
C15 Atomic, Molecular & Optical Physics	William van Wijngaarden (Chair)	York University, Toronto, Canada
C17 Quantum Electronics	Dick Slusher	Georgia Tech, Atlanta, USA
C20 Computational Physics	Risto Nieminen	Helsinki Technical University, Finland
NANOAFNET	M. Mazza (Associate Member)	iThemba Labs, Cape Town, South Africa
AC1 Optics	Angela Guzman (Associate Member)	Universidad Nacional de Colombia Bogotá, Colombia