

## Item 4: Minutes of Meeting of IUPAP Nanoscience Working Group

April 15-16, 2005

École Normale Supérieure, Paris, France

**Present:** M. Coey, J. Dalibard, R. Nieminen, H. Orland, P. Ormos, M. Paalanen, Y. Petroff, R. Slusher, W. van Wijngaarden (Chair)

**Regrets:** E. Gornik

### Friday April 15

1. The meeting began at 4:00 pm.
2. **Introduction:** All members introduced themselves. J. Dalibard noted that he considers himself an AMO (Atomic, Molecular & Optical) physicist even though he is representing Condensed Matter. W. van Wijngaarden said the chair of the Condensed Matter commission had appointed J. Dalibard as their representative as they consider his expertise in the field of ultracold atoms as an integral part of recent exciting research developments in the Condensed Matter field.
3. **Initial Presentation:** W. van Wijngaarden gave a presentation that reviewed the following (See Appendix I).
  - a. Rationale for Establishment of Nanoscience Working Group by IUPAP
  - b. Mandate
  - c. Organization
  - d. Membership
  - e. Written Report to be submitted to IUPAP General Assembly
  - f. Proposed Agenda of Meeting
4. **Remarks by Y. Petroff:** IUPAP's President Y. Petroff, commented that nanoscience is a rapidly developing area affecting many commissions. Hence, it is not useful to set up a separate commission. He noted that some Condensed Matter physicists were not aware of recent developments regarding cold bosons/fermions that have occurred in the area represented by Commission 15 (Atomic, Molecular and Optical Physics). IUPAP therefore established the working group to facilitate cooperation amongst the various commissions. One possible outcome might be the organization of a small conference restricted to one area of nanoscience such as for example Ultracold Atoms. A subsequent conference could focus on the role of nanobiophysics. He emphasized that each meeting should not attempt to cover all areas of nanoscience as this would be too large. Moreover, the meeting should not duplicate existing conferences that focus on technological applications of nanoscience but rather emphasize the physics.
5. **Discussion**
  - a. **What is Nanoscience?:** A discussion was held on how nanoscience is defined. An obvious answer is that it refers to the study of physical quantities/processes occurring on scales less than a few hundred nanometers. Everyone agreed that Nanoscience does not encompass nuclear and high energy physics that involve very small distance scales. It

was also felt that atomic physics was not included because simple atoms don't have sufficient complexity or structure.

- b. **Some Interesting Areas of Nanoscience:** It was noted that Nanoscience is used to describe a great variety of research. P. Ormos noted that it is used in Biophysics to describe protein studies and even manipulation of a single molecule such as DNA. Chemists refer to surface studies as nanoscience as the surface thickness has a dimension of only a few nanometers. H. Orland noted that nanoscience is not limited to only applications but developing computational models to understand the various processes important in the field. R. Nieminen noted that semiconductors are continuing to shrink in size and the challenge of using quantum mechanics to describe future semiconductor devices is very important. M. Paalanen commented that caution should be exercised when promising applications of nanoscience. Y. Petroff gave the example of the failure of high T<sub>c</sub> superconductivity to yield any important applications after 15 years.
  - c. **Ultracold Atoms and Nanoscience:** J. Dalibard noted that the rapid developments in ultracold atoms provide a very interesting Quantum Mechanical system. The development of quantum computing may facilitate the understanding of complex quantum systems. Several individuals asked how cold atoms fit the definition of Nanoscience as typical sizes of BEC clouds are on the order of microns. Y. Petroff thought that the developments in cold atom physics are a very interesting topic and we should not be limited by a rigorous definition of size when defining nanoscience. M. Paalanen noted that unfortunately very few cold atom AMO physicists attended Low Temperature Physics meetings. P. Ormos did not see how ultracold atoms and biophysics could fit together at a meeting.
  - d. **Involvement of Various Commissions in Nanoscience Areas:** Several people commented that different areas of nanoscience involve some commissions more heavily than others. For example, Bionanoscience strongly involves physicists represented by the Biophysics, Statistical, Computation and Quantum Electronics Commissions. Alternatively, ultracold atom studies involve researchers represented by the Low Temperature, Condensed Matter, Atomic, Molecular and Optical Physics Commissions.
  - e. **Nanoscience vs. Nanotechnology:** Everyone agreed on the importance of a future conference emphasizing nanoscience rather than nanotechnology which is already featured at a number of large meetings. Any meeting should not attempt to duplicate existing meetings such as Gordon Conferences. Y. Petroff commented that a conference dealing with technological applications of nanoscience would be unmanageably large.
6. **Adjournment:** The meeting adjourned for dinner at 6:00 pm.

## Saturday April 16

1. The meeting began at 10:00 am.
2. **Commission Presentations:** Each member gave a short talk describing the role nanoscience has played at recent IUPAP sponsored conferences in their commission. This was followed by a presentation of interesting nanoscience research results. Each talk is given in the appendices as follows.
  - a. C3 Statistical Physics H. Orland
  - b. C5 Low Temperature Physics M. Paalanen
  - c. C6 Biological Physics P. Ormos
  - d. C9 Magnetism M. Coey
  - e. C10 Condensed Matter J. Dalibard
  - f. C15 Atom, Mol & Opt Physics W. van Wijngaarden
  - g. C17 Quantum Electronics R. Slusher
  - h. C20 Computational Physics R. Nieminen
3. The meeting adjourned for lunch from 12:30 to 2:00.
4. **Conclusions:** It was decided that a conference narrowly focused on one area of nanoscience would be useful to improve the synergy between researchers in the various commissions. Meetings could be held every 2 years on a different frontier area of nanoscience. The meetings should be small limited to between 75 and 150 people to facilitate interaction between scientists from different backgrounds. Future conference topics would be reviewed after each meeting to respond to exciting research developments in nanoscience.
5. **IUPAP Support:** Y. Petroff indicated that IUPAP would support a small meeting described as above with about \$10,000. This funding is larger than is typically given to such meetings because IUPAP regards such nanoscience meetings as a very important initiative.
6. **Priority of Nanoscience Meeting Topics:** The representatives of the commissions unanimously agreed on the following rankings for possible meeting topics. It was felt that the first meeting should clearly be within the generally understood confines of nanoscience i.e. physics of things smaller than a few hundred nanometers. The various commissions involved in these meetings are listed below. A star designates the commission that would take leadership of organizing the meeting.
  - i. **Nanobioscience**
    - a. C3 Statistical Physics
    - b. \*C6 Biological Physics
    - c. C9 Magnetism
    - d. C17 Quantum Electronics
    - e. C20 Computational Physics

**ii. Quantum Degenerate Matter**

- a. C3 Statistical Physics
- b. C5 Low Temperature Physics
- c. C10 Condensed Matter
- d. \*C15 Atomic, Molecular & Optical Physics
- e. C17 Quantum Electronics
- f. C20 Computational Physics

**iii. Nanoscale Transport**

- a. C3 Statistical Physics
- b. C5 Low Temperature Physics
- c. C6 Biological Physics
- d. C8 Semiconductors
- e. \*C9 Magnetism
- f. C10 Condensed Matter
- g. C20 Computational Physics

7. **Organization of Nanobioscience Meeting:** This will be undertaken by the working group representatives of the involved commissions listed above i.e. C3-H. Orland, C6-P. Ormos, C9-M. Coey, C17-R. Slusher and C20-R. Nieminen and will be chaired by P. Ormos. **Action:** This group will report back by the end of May, 2005 on its progress on the following.
- a. Check that there are no similar conferences.
  - b. Create a Program/Organizing Committee having at least 10 members. IUPAP regulations regarding gender composition should be kept in mind.
  - c. Select conference date during 2006 as well as a location.
  - d. Create draft list of invited speakers and session titles
  - e. Create Local Organizing Committee
8. **Things to Do:** Each representative of the working group is asked to finalize their presentations and return to W. van Wijngaarden by the end of April. The presentations will then be circulated to all commission members and also be part of the final written report of the Working Group to IUPAP. These presentations should be in powerpoint and not more than 20 pages long.
9. **Miscellaneous:** W. van Wijngaarden asked everyone to complete the IUPAP expense form and send to J. Beamon for reimbursement. J. Dalibard was thanked for his hospitality in hosting the meeting.
10. **Adjournment:** The meeting adjourned at 5:00 pm.