Oxford Undergraduate Physics Conference 2007

Report for Physics Academic Committee

1 Venue and Date

The first OUPC took place in the Mary Sunley Building at St Catherine's College, over two days: 16 – 17 April 2007 (Monday and Tuesday of 0th Week of Trinity Term). The Mary Sunley Building was an excellent venue — good size for the event, modern facilities (data projector, large sceens, air conditioning), separate room for coffee breaks, several separate spaces for parallel sessions. Lunches were served in Hall. The handling of dietary requirements was an additional task, as some requirements needed several email exchanges to sort out, but the College staff were very experienced and there were no problems the once ambiguities had been sorted out.

The choice of date seemed to work well: naturally some pepole would have preferred a different date, but it was adjacent to term without encroaching in any way on term-time activities, and most participants approved the date.

2 Organisation

I recruited a committee of four second years to help me with running the event, and they were a valuable source of ideas for what we should include. We met several times during Michaelmas and Hilary Terms, and communicated quite a lot by email. In the final stages of preparation I had assistance from Carrie and Hannah Glanville for copying, printing lists and the feedback questionaire, and handing out conference folders on the first morning.

3 Publicity and Numbers

There was a conference poster, designed by one of the committee, printed by OUCS and distributed by the committee at the beginning of Hilary Term. All second years were emailed by me at that time with details. Reminder emails were sent at intervals during Hilary Term. At the end of Hilary Term the event was opened to third years, and one fourth year who had seen the posters enquired directly. Bookings came in quite slowly, and in future I would start the process in Michaelmas Term, and extend bookings to third

years in the middle of Hilary Term. The logging of bookings in a spreadsheet was done by one of the Committee members, and cheques were handled by me using my College pigeon-hole for collection (for reasons of security). The total number of bookings was 40, and after a small number of students had to pull out at short notice for various reasons the final number attending was 35.

4 Content

The educational purpose of the event was to link together subjects studied in different papers, and to push the boundaries of the syllabus, without encroaching on subjects studied in Parts B and C, and all content was selected with this in mind

An early decision was that we should not just have talks/lectures, but vary the activity, and also work in smaller groups. The final timetable had plenary sessions in the lecture theatre in the mornings and the late afternoon, and a period in the early afternoon with three parallel sessions. Most of the parallel sesions were devoted studying 'classic papers', which proved very popular, and very little work for those leading the sessions. Some of the committee desired a 'hands-on' activity as an option for the parallel sessions, and some effort was put into trying to identify something suitable, perhaps involving lecture demonstrations. In the end this came down to a session involving a small climate model in conjunction with the talk, which ran on 8 PCs in the coffee area.

4.1 Talks

There were a total of six talks:

- **The Atomic Hamiltonian (Christopher Palmer).** In this talk I derived the correct form for the nuclear motion terms ('mass polarization'), nuclear finite size and Breit interaction terms in the atomic Hamiltonian, thus linking the further quantum mechanics course with some classical mechanics and some electromagnetism.

- **Climate Prediction (Myles Allen).** Myles discussed the recent Assessment of the IPCC, and gave a reasoned critique of the likely response from the forthcoming G8 summit. This could be said to encroach on B3 — the talk was included after a request from the Committee ('We've never heard anyone talk in an adult way about climate change, and it's going to affect us'). In fact Myles' approach was much more about differential equations and probability theory than physical processes, so in fact there was no real overlap.

- **Exact Slit Diffraction (Geoff Brooker).** Geoff has been evaluating an exact solution to Maxwell's equations for diffraction through a single slit, and the talk thus tied together some loose ends in electromagnetism and optics. (This was a remarkable talk, as the only previous exact solution is that of the half-plane due to Sommerfeld (1896)!)

- **Entropy and Information (Steve Blundell).** This was another suggestion of the committee - a talk based on things that might have been included in his undergraduate lectures had there been time.

- **Atomic Frequency Standards (Patrick Gill, NPL).** Patrick is a Visiting Professor and readily agreed to give a talk based on current work at NPL developing single atom clocks more accurate than the caesium fountain that provides the current definition of the second. This significantly extended the boundaries of the further quantum mechanics syllabus.
- **The Virial Theorem (Christopher Palmer).** This talk was added at a late stage after another speaker had to postpone to another year, and discussed both the classical and QM derivations of the virial theorem and some applications.

4.2 Classic Papers

There were two groups of three parallel sessions.

- **Newton's *Principia* (John Roche).** John led students through Newton's derivation of the inverse square law. This was the most popular talk in this group of three.
- **Einstein (1905) Brownian motion (Christopher Palmer).** The paper for which Einstein got the Nobel Prize, although rather overshadowed now by the others of that year. Short enough for line-by-line study, and worked very well.
- **Climate Model (Myles Allen).** This was a speadsheet-based climate model comparing twentieth-century temperature data with the time-variation of several relevant climate factors.
- **Bell's Inequality (Harvey Brown).** This was the paper 'Bertleman's socks and the nature of reality' which is studied by the P&Ps.. This was the most popular session in this group of three, and produced very positive feedback.
- **Quantum Teleportation (Jonathan Jones).** This was Jonathan's suggestion, at quite short notice to fill a gap. Again a short paper (Phys. Rev. Lett.) with enough time to study line-by-line.
- **Millikan's photoelectric effect papers (Christopher Palmer).** Millikan's great experimental tour-de-force — a precise verification of Einstein's photoelectric effect equation at the fraction of percent level, grudgingly admitted through clenched teeth by the man who set out to disprove it! Two quite long papers, we had to cherry-pick a little.

My warm thanks to all who contributed to the Conference content.

5 Feedback

A short questionaire was distributed to obtain feedback from participants. There was unanimous approval, and many very positive comments. Speakers also commented on how lively and interactive their audience was, and in general a very good time was had by all. An interesting feature was the enthusiasm for the historical and philosophical sessions. There was a widespead view that the event should become an annual fixture.