YAO 2007 Final Report

Summary:

The 13th Young Atom Opticians conference (YAO) was held at Durham University from 27-31st March 2007. More than eighty early-career atomic physicists from 12 countries presented their research at the conference via posters, 15 minute talks and/or 25 minute talks. The content of the presentations was quite varied, encompassing both theoretical and experimental topics, and featuring projects in the early stages as well as new results from established research programmes. Two invited speakers, Professors Tilman Esslinger and Ed Hinds, augmented the scientific programme with talks on lattices and the physics of phase transitions, and on the technical aspects of designing atom chips, respectively. A representative of one of the conference's corporate sponsors also gave a short talk on the physics of different types of diode lasers. Poster sessions, a conference dinner, and a social trip one afternoon provided opportunities for informal discussions and networking. The conference dinner concluded with the awarding of prizes for best poster and short talk, and with the announcement that the 2009 YAO conference will be held in Vienna.

Scientific content:

I. Overview

As the conference contained 64 separate talks and well over 60 posters (including 21 not accompanied by talks) on a wide variety of topics, it is beyond the scope of this report to describe the scientific content of each one individually. A complete picture of the physics presented at the YAO 2007 conference is found in the conference book of abstracts, which may be downloaded directly from the conference website (http://massey.dur.ac.uk/yao/Abstract_Book.pdf). However, several common threads did emerge over a week's worth of presentations and discussions. These are briefly summarised here.

II. Common Threads

The first common thread was a broad interest in the physics of two or more species of cold atoms and their interactions. This area of research was discussed in presentations by Philipp Ernst (Hamburg), Johannes Will (Hannover), Chiara D'Errico (Firenze) and Jean-Francois Clement (Palaiseau) on K-Rb systems; Florian Baumer (Dusseldorf) on multi-isotope Yb-Rb mixtures; Quentin Beaufils (Paris) on Bose-Fermi mixtures of different chromium isotopes; experimental studies by Andrea Prantner (Innsbruck), Shincy John (Bonn), Margaret Harris and Patrick Tierney (Durham) on Rb-Cs mixtures; and Frederik Speigelhalder (Innsbruck) on fermionic Li-K mixtures.

The field of atom chips was also well-represented, with many presentations on both theoretical and technical aspects of trapping atoms on a chip. One of the invited speakers, Professor Ed Hinds (Imperial College London), devoted a large part of talk to some of the interesting challenges associated with fabricating atom chips, including the possibility of creating a large array of microscopic magneto-optical traps on a chip. Presentations by Pascal Boehi and Stephan Camerer (Munich), Clement Lacroute (Paris), Russell Anderson (Melbourne), Rob Sewell (London), Florian Baumgaertner (Vienna), and Jean-Baptiste Trebbia and Kenneth Maussang (Palaiseau) all discussed new experimental and theoretical studies of atom chips.

Several members of the QUANTUS collaboration spoke on various aspects of their work on ultracold quantum gases in microgravity. One of their experiments was actually 'flying' on a zero-G aircraft during the conference, and the novel challenge of keeping lasers locked on an aircraft in parabolic flight provoked many discussions among conference attendees (particularly experimentalists).

Finally, many delegates presented work with applications to quantum control or quantum computation. These included Elisabeth Kierig (Heidelberg)'s talk on controlling single particle tunnelling; Naceur Gaaloul and Alpha Gaetan's theoretical and experimental (respectively) studies of single qubit operations at Orsay; David Szwer (Oxford)'s talk on quantum information processing with calcium ions; Dan Crick (London)'s talk on a new design for a scalable ion trap; Charles Tuchendler (Palaiseau)'s work on cold controlled collisions in a dipole trap; theoretical studies of quantum optical logic by Mark Everitt (Leeds); Kari Harkonen's models of the dynamic control of motional states (Turku); and proposals for coherent momentum manipulation of 85Rb by Matt Himsworth and James Bateman (Southampton). Several other projects presented at the conference listed quantum computation as a long-term goal, consolidating its status as a 'hot topic' in the field.

III. Invited speakers

The YAO conference programme featured talks by two invited speakers. As noted in the previous section, Professor Ed Hinds of Imperial College London spoke about the fabrication of atom chips and their future applications. The other invited speaker, Professor Tilman Esslinger of ETH Zurich, gave a more theoretical talk on the physics of phase transitions between thermal and Bose-Einstein condensed gases and the physics of fermionic atoms in optical lattices. Finally, a representative from Toptica (one of the conference's corporate sponsors) gave a brief presentation on the physics of diode lasers, their design, and some limitations.

IV. Prizes

The quality of both talks and posters was very high, and this was reflected in the voting for prizes which took place near the end of the conference. Of the 60+ posters presented at the three poster sessions, more than 40 received at least one vote from the other attendees. Of these, nearly 30 received at least two votes – a testament to the difficulty of picking a winner from so many well-qualified entries. The six prizes went to Andrea Prantner (Innsbruck), Matthias Lettner (Garching), and Timo Ottenstein (Heidelberg) for the posters, and Alpha Gaetan (Orsay), Matthias Gustavsson (Innsbruck), and Stefan Trotzky (Mainz) for the short talks.

V. Discussions and networking

The timetable of the YAO conference provided many opportunities for discussions and networking, and the delegates took full advantage of them. The three poster sessions were particularly noteworthy for the tremendous levels of participation. Despite a very full programme of talks (which on some days stretched from 8:30 a.m. until after 5 p.m.), all three evening poster sessions were very well-attended, with participants continuing their discussions at more informal venues after the poster area closed at 10 p.m. Feedback from participants at the close of the conference indicated that the poster sessions were a highlight of the conference, and several collaborations have developed out of discussions there.

VI. Cold Matter Forum

One final noteworthy aspect of the scientific programme at YAO 2007 was that another atomic physics conference, the Cold Matter Forum, was also taking place at Durham University during the first two days of YAO. This fortunate scheduling coincidence meant that several CMF participants also attended one or more talks given by YAO delegates, and a large number came to the YAO poster sessions. YAO participants were therefore able to discuss their work with more established members of the European atomic physics community as well as with their peers.

Assessment of results and impact:

I. Feedback from delegates

Delegates to YAO 2007 were overwhelmingly positive in their comments to the five organisers. There was general agreement that the conference had run smoothly, that the quality of science presented had been very high, and that the poster sessions, in particular, were both enjoyable and interesting.

Other positive points raised at a feedback session at the end of the conference were:

- everyone who wanted to give a talk was allowed to do so
- the combination of short talks followed by posters was particularly effective for reaching both a general audience and specialists within the sub-field
- the number of posters was 'about right' and there was enough time to see most of them over the course of the three sessions
- the informal nature of the poster sessions was 'a big plus'
- the short talk on diode lasers by a representative of one of the corporate sponsors was useful and interesting
- signs posted between the railway station and the conference area were helpful and welcoming

Some suggestions for ways to improve the conference in future years were:

- better organisation of the timetable
- more timely communication upon receipt of applications
- provision of a room somewhere in the college for people to chat informally after poster sessions in the evening
- a social event earlier in the conference for meeting people
- a less compressed programme to allow more time to absorb new information

It was suggested that one way to make the programme less compressed would be to have 'break-out' sessions on individual topics for part of the time. The organisers had specifically avoided grouping talks together by topic because it was felt that this would fragment the conference. However, one afternoon dedicated to parallel sessions on common topics would have allowed more time for breaks without compromising the goal of giving everyone the opportunity to speak, and without dividing the participants unnecessarily.

II. Impact on the field

By their very nature, YAO conferences have a potential for tremendous impact on the future direction of the field of atomic, molecular and optical physics. For many participants, YAO is their first chance to present research to an international audience. Since that audience is almost entirely composed of their fellow postgraduate students, the experience is likely to be both helpful and free from the sometimes intimidating atmosphere which an early-career researcher might

experience at other conferences. YAO is therefore not only a scientific meeting in its own right, but also a means of nurturing and providing opportunities for talented young scientists.

While it is difficult to assess the impact of YAO 2007 at this point, it is worth noting that a large fraction of the current population of European atomic physicists attended one of the early YAO conferences. Many of this year's YAO participants will undoubtedly continue on to careers in academia, industry, or other technical fields, and the connections made and information learned at this year's YAO will continue to serve them well for years to come.

Following this year's conference, the unique character of YAO and its role in the field were highlighted in a letter to Nature Physics (Jean-Baptiste Trebbia et al, Nature Physics 3 287, 2007) which discussed the 2007 YAO and the history of the conference since its inception in 1995.

Conference Timetable