

# Particle Physics and Schools in the UK

## Background

The great majority of pupils in the UK study science up to the age of 16, with physics being a significant part of the curriculum. Within this framework, they learn about the atom, the nucleus and electrons. A small minority study a separate physics GCSE which has a short section looking at quarks and leptons.

At 16+ a minority of students continue to study physics - at A Level in England, Wales and Northern Ireland and Higher/Advanced Higher in Scotland. Most of these courses include coverage of quarks, leptons and forces in a largely descriptive manner. This generally proves to be a popular section of the course with students. It is also a section which causes problems to many teachers - particularly those who graduated some years ago and those whose degree is not in pure physics (e.g engineering).

This paper will concentrate largely on post-16 issues which is where the bulk of Particle Physics is taught.

## Support for Schools and Teachers

- **Supporting Organisations.** The Institute of Physics (IoP) and the Association for Science Education (ASE) both have programmes of support for teachers. PPARC works with both and uses their communications systems (journals, direct mailshots) to communicate with teachers. The physics teachers e mail network run by the IoP also provides a valuable tool for communication and mutual support for physics teachers.
- **PPARC Schools Liaison Officer.** PPARC employ a Part-Time Schools Liaison Officer (Andrew Morrison) who provides a link between the Research and Education communities in the UK.
- **PPARC Resources Guide.** PPARC publish a resources guide for teaching particle physics - which lists books, magazines, posters, work packs, software, web sites and useful contacts. ([www.pparc.ac.uk/Ed/ppres\\_index.asp](http://www.pparc.ac.uk/Ed/ppres_index.asp))
- **The National Particle Physics Masterclass.** These are one-day events which mix talks about aspects of modern particle physics with the use of computers to examine real or simulated events. They are run by the Institute of Physics High Energy Particle Physics Group (IoP HEPP Group) and take place in around 15 institutions around the UK, and are attended by around 2000 students from 200 schools.
- **Talks for Schools.** These may be requested by schools or groups of schools. The PPARC Schools Officer maintains a list of speakers on behalf of the IoP HEPP Group. This list is part of the ppUK website (<http://hepweb.rl.ac.uk/ppUK>) supported by PPARC. The Institute of Physics also supports a lecture series for schools which recently included a major lecture tour by Peter Kalmus. Previous highlights (such as the Royal Institution Christmas lectures by Frank Close) are generally available on video by free loan from the IoP.
- **Training for Teachers.** PPARC supports two annual 4 day courses on Particle Physics for teachers which take place at the Universities of Manchester and Bristol. The Goldsmith's company (a charity) supports a similar course in London (which includes a day visit to CERN). The Institute of Physics run Update Courses for teachers, most of

which include a briefing on modern particle physics. Other institutions (e.g. the Rutherford Appleton Laboratory and University HEPP Groups) run occasional or regular events which often include updates on particle physics. The annual meeting of the UK Association for Science Education (ASE) attended by over 2000 teachers, has featured theme days on Particle Physics and the PPARC lectures (recently given by Christine Sutton and Frank Close).

- **Visits to CERN.** PPARC provides guidance for schools who wish to visit CERN in the form of "Visiting CERN from the UK". This is at <http://ukvisits.web.cern.ch/ukvisits>. Between April 2001 and April 2002, there were 61 school visits (figures from CERN Visits Service). PPARC also provides financial support for UK teachers to attend Physics Teachers @ CERN. (In the past three years over 60 UK teachers have been supported in this way).

## Resources

- The PPARC schools officer gives regular talks to teacher groups (organised by the UK Association for Science Education) outlining the resources and support available for teaching in the PPARC areas of physics.
- Most of the 6 A level courses in England have course-specific materials to support teachers. This is particularly true of the courses supported by the Institute of Physics (Advancing Physics) and the University of York education group led by Dr Elizabeth Swinbank (Salters Horners A Level). These have written materials, CD Rom based material and student activities available. Preparation of Particle Physics materials involved consultation with practising researchers.
- A major resource - Particle Physics: a New Course for Schools and Colleges (1991 so not so new now!) produced by the University of York education group is a comprehensive course incorporating an Open University unit.
- PPARC produce a series of A2, double sided posters suitable for the general public and 16+ students on topics such as Particle Accelerators and Neutrinos. They also produce a cartoon-style poster series suitable for younger pupils - including, for example, Matter and Antimatter (see <http://www.innotts.co.uk/~iamorrison/am.pdf>). Other organisations produce posters on a commercial or sometimes non-profit basis. This includes, for example, a poster from PCET on the Standard Model (see <http://www.pcet.co.uk/system/index.html>) prepared with support from PPARC and help from Peter Kalmus.
- Software. The packages used at Particle Physics Masterclasses (the Lancaster Package produced with support from PPARC, and various packages produced by other universities) are also freely available for the use of teachers in schools. PPARC also fund a site - World of Particles - which is suitable for pupils aged 11-16 which give basic information about particle physics. See [www.schoolscience.co.uk](http://www.schoolscience.co.uk)