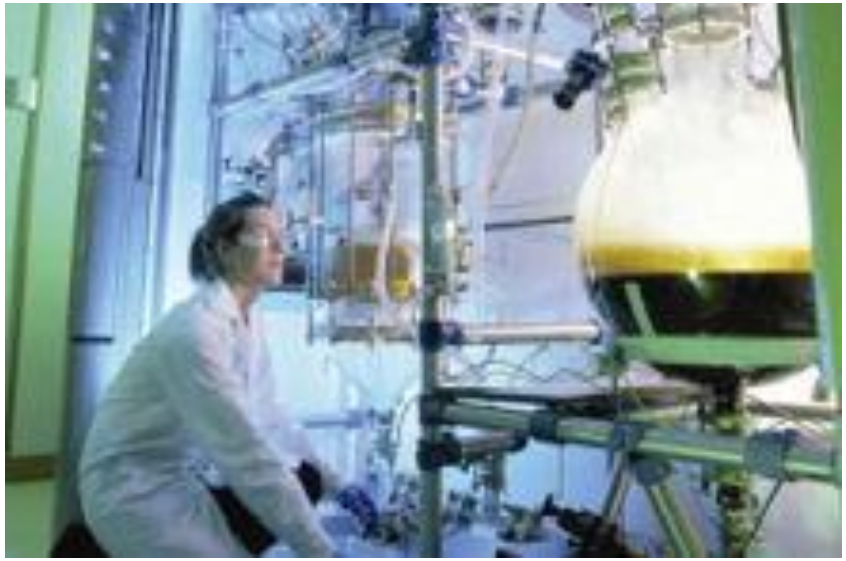
# Helping students into the job market?



David Cole-Hamilton

Quality Assurance Agency (Scotland)

Enhancement theme - Employability

# Major Themes

**Subject specific Expertise**

Project work

Transferrable skills

Work Placement

Personal development Planning

Student Enterprise

**Embedded within the curriculum**

# Project work

A significant piece of original research leading to a thesis

- Independent thought
- Deductive reasoning
- Literature abstracting
- Research planning
- Research skills and instrumentation
- Communication (Colloquium, poster, writing)
- Publications or patents

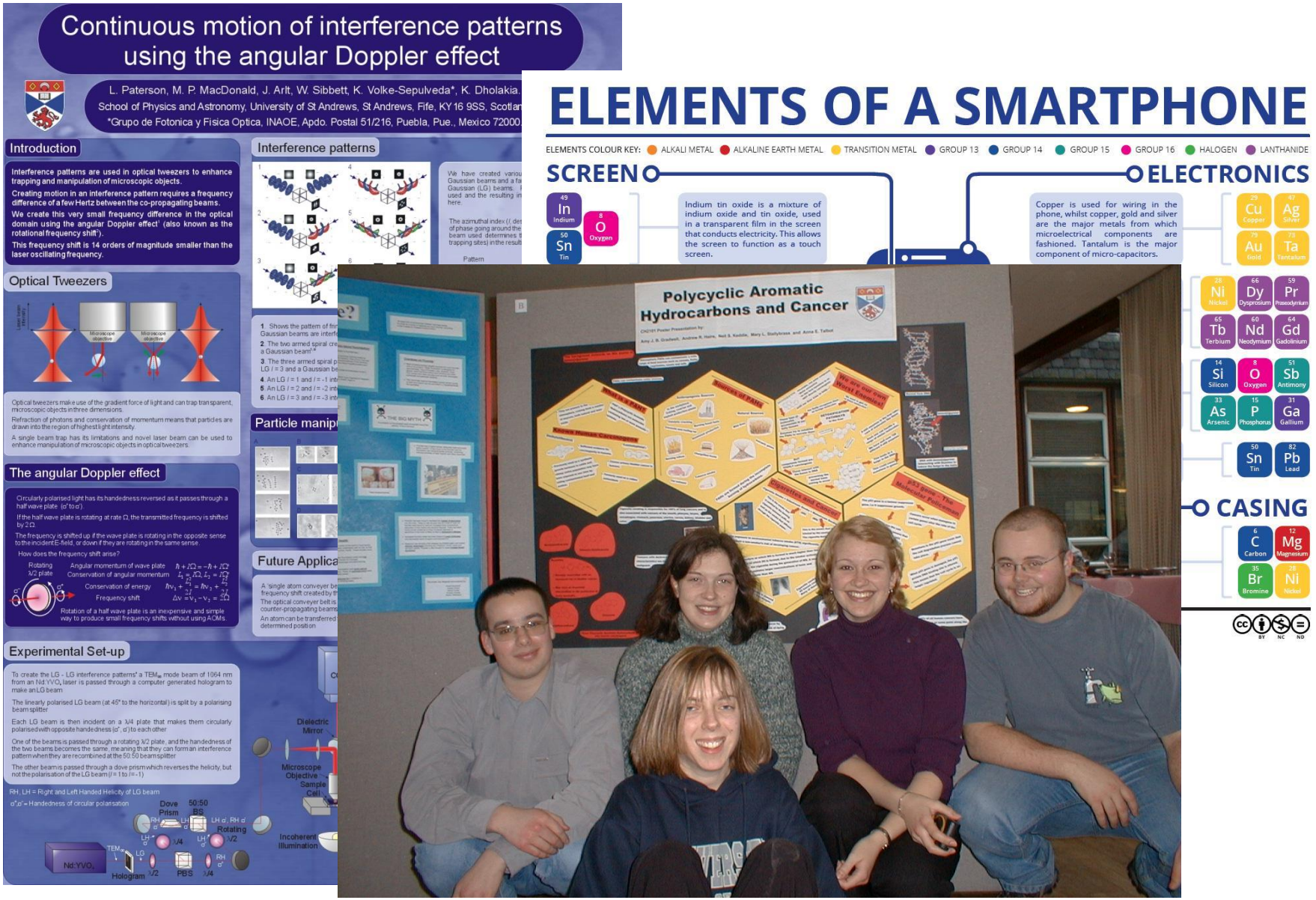
# Transferable skills Embedded in the Curriculum

Posters
Oral presentations
Essays
Chemical Newspaper
Miniproject

All involve

**Teamwork**

# Posters


Continuous motion of interference patterns using the angular Doppler effect
L. Paterson, M. P. MacDonald, J. Arlt, W. Sibbett, K. Volke-Sepulveda*, K. Dholakia.
School of Physics and Astronomy, University of St Andrews, St Andrews, Fife, KY16 9SS, Scotlan
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Introduction
Interference patterns are used in optical tweezers to enhance trapping and manipulation of microscopic objects.
Creating motion in an interference pattern requires a frequency difference of a few Hertz between the co-propagating beams.
We create this very small frequency difference in the optical domain using the angular Doppler effect' (also known as the rotational frequency shift').
This frequency shift is 14 orders of magnitude smaller than the laser oscillating frequency.
Interference patterns
Optical Tweezers
Optical tweezers make use of the gradient force of light and can trap transparent, microscopic objects in three dimensions.
Refraction of photons and conservation of momentum means that particles are drawn into the region of highest light intensity.
A single beam trap has its limitations and novel laser beam can be used to enhance manipulation of microscopic objects in optical tweezers.
Particle manipu
The angular Doppler effect
Circularly polarised light has its handedness reversed as it passes through a half wave plate (σ+ to σ-).
If the half wave plate is rotating at rate Ω, the transmitted frequency is shifted by 2Ω.
The frequency is shifted up if the wave plate is rotating in the opposite sense to the incident E-field, or down if they are rotating in the same sense.
How does the frequency shift arise?
Rotating λ/2 plate
Angular momentum of wave plate
Conservation of angular momentum
Conservation of energy
Frequency shift
Rotation of a half wave plate is an inexpensive and simple way to produce small frequency shifts without using AOMs.
Future Applica
Experimental Set-up
To create the LG - LG interference patterns* a TEM00 mode beam of 1064 nm from an Nd:YVO4 laser is passed through a computer generated hologram to make an LG beam
The linearly polarised LG beam (at 45° to the horizontal) is split by a polarising beam splitter
Each LG beam is then incident on a λ/4 plate that makes them circularly polarised with opposite handedness (σ+, σ-) to each other
One of the beams is passed through a rotating λ/2 plate, and the handedness of the two beams becomes the same, meaning that they can form an interference pattern when they are recombined at the 50:50 beamsplitter
The other beam is passed through a dove prism which reverses the helicity, but not the polarisation of the LG beam (l = 1 to l = -1)
RH, LH = Right and Left Handed Helicity of LG beam
σ+,σ- = Handedness of circular polarisation
Dielectric Mirror
Microscope Objective
Sample Cell
Incoherent Illumination
Dove Prism
50:50 BS
Rotating λ/2
Nd:YVO4
Hologram
PBS
ELEMENTS OF A SMARTPHONE
ELEMENTS COLOUR KEY: ALKALI METAL ALKALINE EARTH METAL TRANSITION METAL GROUP 13 GROUP 14 GROUP 15 GROUP 16 HALOGEN LANTHANIDE
SCREEN
In Indium
O Oxygen
Sn Tin
Indium tin oxide is a mixture of indium oxide and tin oxide, used in a transparent film in the screen that conducts electricity. This allows the screen to function as a touch screen.
ELECTRONICS
Copper is used for wiring in the phone, whilst copper, gold and silver are the major metals from which microelectrical components are fashioned. Tantalum is the major component of micro-capacitors.
Cu Copper
Ag Silver
Au Gold
Ta Tantalum
Ni Nickel
Dy Dysprosium
Pr Praseodymium
Tb Terbium
Nd Neodymium
Gd Gadolinium
Si Silicon
O Oxygen
Sb Antimony
As Arsenic
P Phosphorus
Ga Gallium
Sn Tin
Pb Lead
CASING
C Carbon
Mg Magnesium
Br Bromine
Ni Nickel
Polycyclic Aromatic Hydrocarbons and Cancer

# Miniproject

- Not research
- Stu
- Res
- Allo
- Des
- Do
- Cor
- Wri
- Giv
- Peer assess one another

# Oral Presentations

# Chemical Newspapers

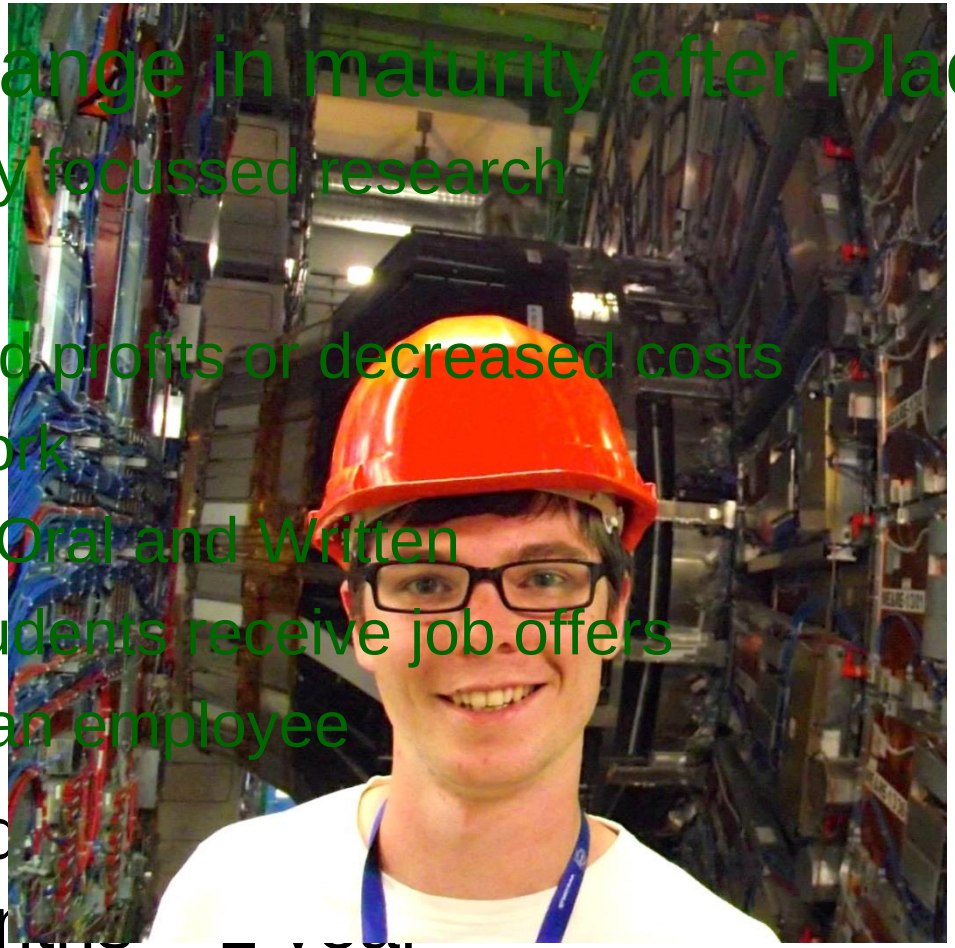
Put together by a team of 5-6 students

# Work Placement

Period spent working outside the University
Usually in a company or Research Institute

Huge change in maturity after Placement

- Company focussed research
- Patents
- Increased profits or decreased costs
- Team work
- Reports Oral and Written
- Often students receive job offers
- Paid as an employee



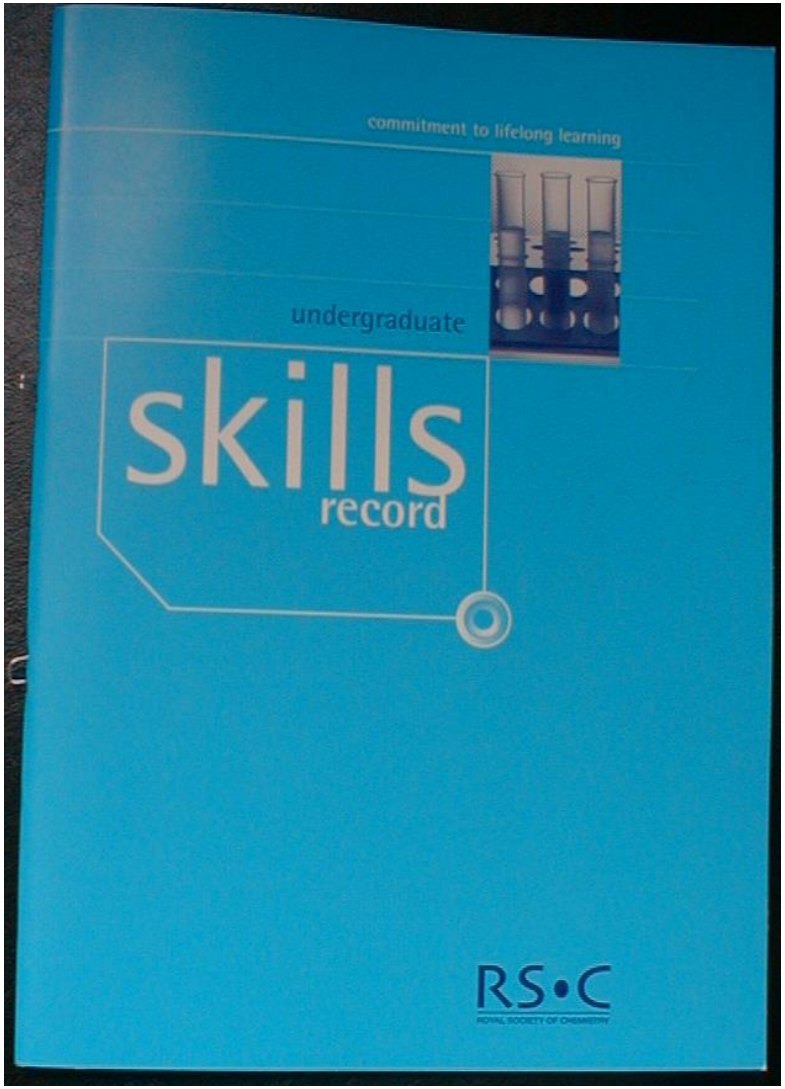
Integrated
8 mon

Vacation job
1-3 months

# Other Disciplines
# Employment or Internship

| | |
|---|---|
| Politics | European Parliament |
| International relations | United Nations |
| Languages | Embassy |
| History | Archival retrieval |
| Psychology | Mental Hospital |
| Law | Law Practice |
| Media | Television |
| Geography | Demographic surveys / Soil analysis |
| Creative Writing | Journalism |

# Undergraduate Skills Record
# Royal Society of Chemistry



# Why do Personal development Planning

*If I ask a student at interview –*

*"Did you do any group work during your undergraduate degree?"*

*and they think for a while before saying*

*"I seem to remember putting a poster together with some other students in Second year"*

*I am not impressed.*

*If they can reply immediately with details of various activities, they are much more likely to get the job*

*Recruitment Officer, Quintiles, Edinburgh*

# Undergraduate skills record

- Student centred
- Regularly updated
- Read over before interviews etc.
- Covers academic and non-academic activities
- Paper, on-line and downloadable formats available

# Showing PDP is worthwhile

- Personal Development planning is for the benefit of the students
- They need to see it as worthwhile
- Senior students acting as mentors help because they can give practical examples of where it was important (Industrial Placement or job interviews)
- A staff member committed to the scheme makes the scheme work.

# Student Enterprise

Business Plan competition

- Work in groups to create a business plan
  - Idea
  - Market research
  - Costing
  - Timescale
- Substantial prizes
- Legal assistance in setting up a spin-out company

# How you can help

- Raise awareness of employability issues within your department
- Think how you can include transferable skills within the modules you teach
- How can external placements be introduced into your department?
- Help and encourage students with personal development planning
- Encourage students to become involved in Student Enterprise

## Teach your own subject brilliantly

EuCheMS
European Chemical Sciences