

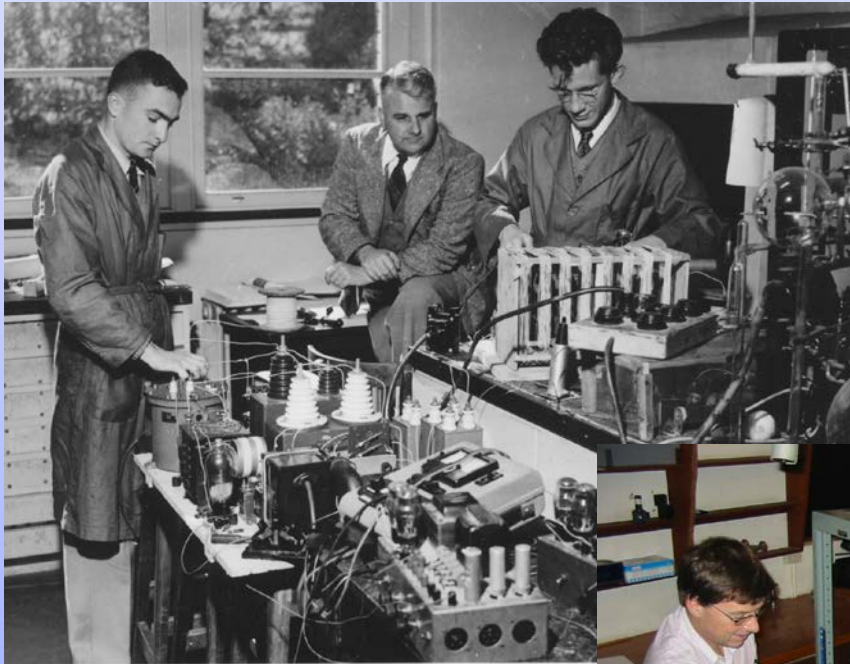
You Teach Mine and I'll Teach Yours

A case study in Collaborative Physics Teaching Across Australia

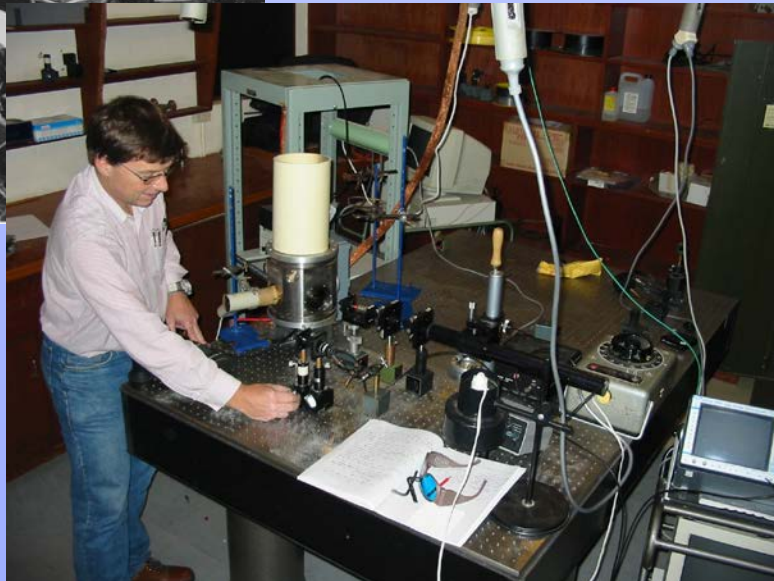
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Physics @ UNE ?



- Physics is one of the oldest disciplines at UNE
- The department has been conducting research for over 65 years



Physics @ UNE ?



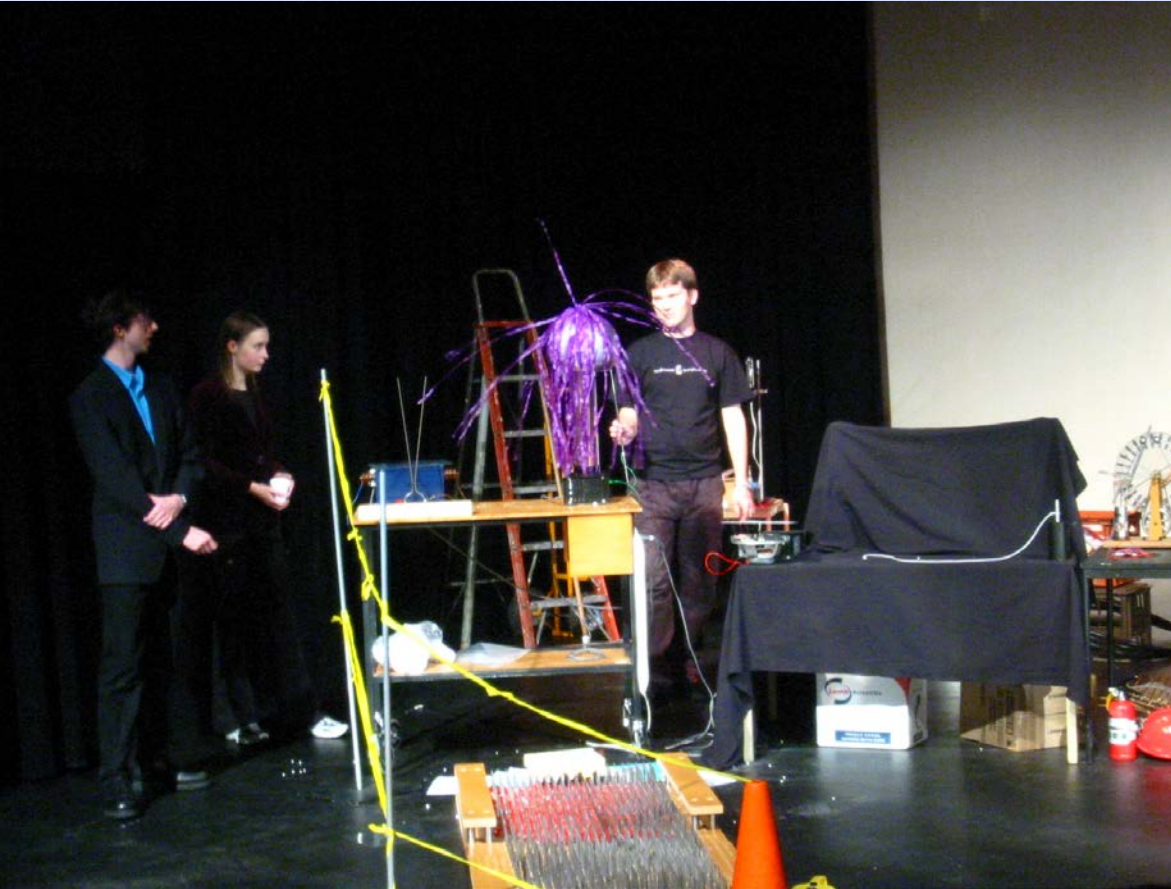
and teaching for over 65
years



Murdoch
UNIVERSITY

UNE
THE UNIVERSITY
OF NEW ENGLAND

Physics @ Murdoch ?



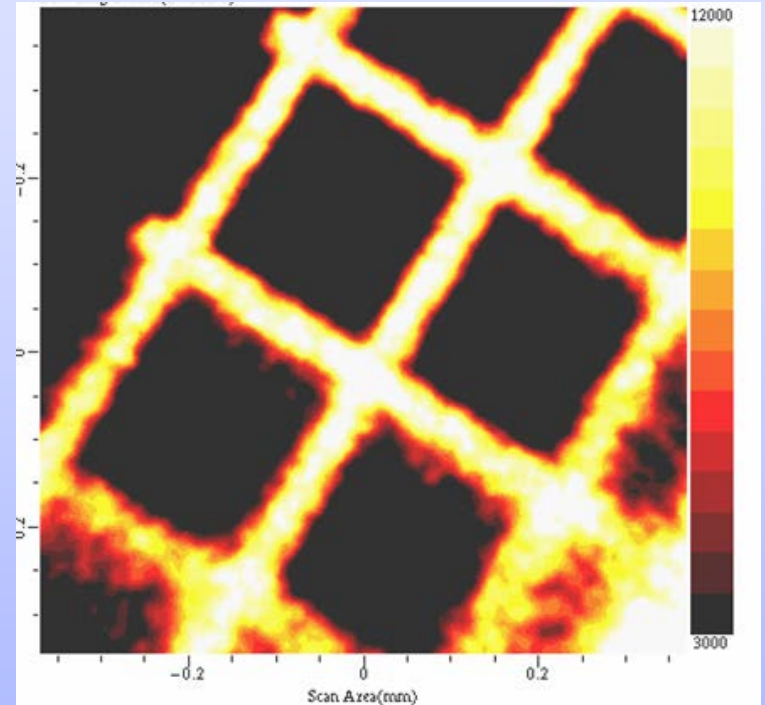
- Physics was there at the start of Murdoch University in 1975.
- They have been offering the Physics degree internally and externally ever since.
- Programs that started in the Physics department and then took on a life of their own are
 - Computer Science
 - Energy Studies
 - Nanoscience



Physics @ Murdoch?

Research at Murdoch includes

- Thin film deposition
- Surface analysis
- Nanoscience
- Science communication
- Learning and teaching



Murdoch
UNIVERSITY

UNE
THE UNIVERSITY
OF NEW ENGLAND

Why?

- Physics departments face increasing financial pressure to reduce unit offerings
- To have accredited degrees they have to retain breadth and depth of topics
- Few universities have the experience / expertise in external Physics units
- Compulsory residential schools
 - students spend time away from their home institutions
 - travel expenses



The Project

- Reciprocal teaching arrangement between
 - Physics and Electronics at University of New England
 - Physics, Energy Studies and Nanoscience at Murdoch University
 - Started in 1998
- Students from Murdoch enrol in UNE
 - Photonics
 - Quantum Physics and Spectroscopy
- UNE physics students enrol in Murdoch
 - Physics of Materials
 - Nuclear and Particle Physics



Collaboration Model Rational

- Science students need to complement theoretical knowledge with hands-on practical experience
- Important students have access
 - to enough sets of top quality equipment
 - for long enough, to get a thorough understanding of the concepts
- Undergraduate labs are very expensive to resource and usually the first casualty of ‘economic rationalism’



Issues

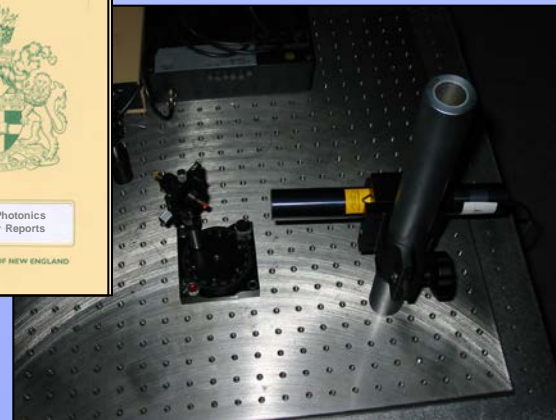
Both Murdoch and UNE have different approaches to dealing with laboratory experiments

- Murdoch send its external students an experimental kit, study guide and written laboratory instructions and then expects the student to get on with it
- UNE brings the students on-campus and provides an intensive residential school
- Both sets of students were unhappy
 - UNE's students because they perceived they were not receiving the same level of care they were use to
 - Murdoch students because they had to travel to Armidale NSW to do labs in what they considered was an external unit



Issues Resolved

- The UNE redeveloped Photonics so the experiments can travel. Now Murdoch University students enjoy a 5-day residential school for UNE's Photonics at Murdoch during the internal teaching period




Issues Resolved

- Photonics went on-line, giving students access to internal lecture slides, chat room, and lecturer feedback.

PHYS212 Photonics

Photonics- PHYS212

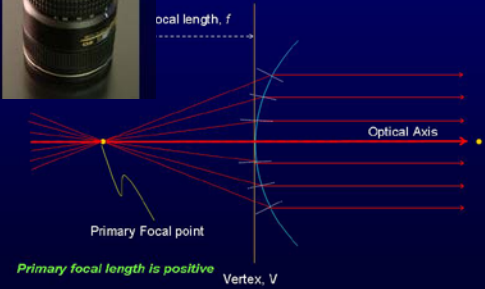
Geometrical Optics



PHYS212 Photonics

and image formation

Primary focal point to the vertex emerge parallel to the optical axis

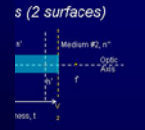


Primary focal length is positive

PHYS212 Photonics

Thick and thin lenses


2 surfaces



Surface powers

$$P_1 = \frac{n}{R_1} \quad P_2 = \frac{n}{R_2}$$

2 thin lenses



Separation, t

Lens powers

$$P_L = P_1 + P_2 - \frac{t}{n} P_1 P_2 \quad P_1, P_2 = \text{Lens powers}$$

$$= P_1 + P_2 \quad \text{if } n' = n = n''$$

Equivalent Thick lens Focal lengths

$$f = \frac{n}{P_L} \quad f' = \frac{n'}{P_L}$$

Equivalent Thick lens Principal points

Surface powers

$$h = \frac{fR_1}{n} \quad h' = \frac{-fR_2}{n} \quad P_1, P_2 = \text{Surface powers}$$

t=lens thickness

$$h = \frac{fR_1}{n} \quad h' = \frac{-fR_2}{n} \quad P_1, P_2 = \text{Lens powers}$$

t=lens separation



Issues Resolved

- For the Murdoch units at UNE a set of laboratory equipment is sent over for use in a ‘supervised’ residential school during the internal teaching period
- Murdoch units are also on-line
- This ‘tuned’ approach to providing practical experience for students has yielded a significant improvement in student satisfaction.



Characteristics of Successful Collaboration

- UNE and Murdoch staff work closely to coordinate assessment tasks and arrange the transfer of equipment across Australia
- Murdoch staff are the on-campus-contact for their students during the semester as are UNE staff for UNE students
- The collaboration is successful because
 - roles and responsibilities of each university are well defined
 - good communication between the staff at both institutions
 - all working towards the common goal of maintaining a viable physics program at our respective universities



How was / will it be evaluated?

- Both universities still have Australian Institute of Physics accreditation for their Physics Degrees
- Both universities have undergraduate physics students.



Astronomy (ASTY221) Class of '05



Growing? Shrinking?

- Getting the external units included in the both university's degree programs was not a big problem thanks to supportive Deans of Faculties
- It took time for
 - the units to progress into the handbook
 - for the students to know about them and enrol in them
 - Academic Renewal at both universities means staff need to continuously make students aware of the opportunities available to them
- Hopefully this will be rectified in due course



Challenges

- Technical
 - Do it yourself kits
- Managerial
 - Exam timetables
- Network oriented
 - University school stability
- Support
 - Technician time
 - Continued support of heads of schools and Deans



Lessons Learned

- There is a need to keep everyone informed – staff and students
- Web based materials assist in this process
- It is useful to have an “on site” representative for the unit who can deal with student questions about the organization of the unit



Our vision ...

- Establish Physics residential school *nodes* at UNE and Murdoch to draw in external students from universities all over Australia

