

# CHAPTER 5

## STEM PATHWAYS: PHYSICS AND ASTRONOMY

### WHAT IS PHYSICS AND ASTRONOMY?

The main purpose of studying and working in Physics and Astronomy is to understand and apply knowledge of the fundamental properties of the universe and the laws which govern its behaviour, and to assess and validate physical phenomena (ABS, 2001).

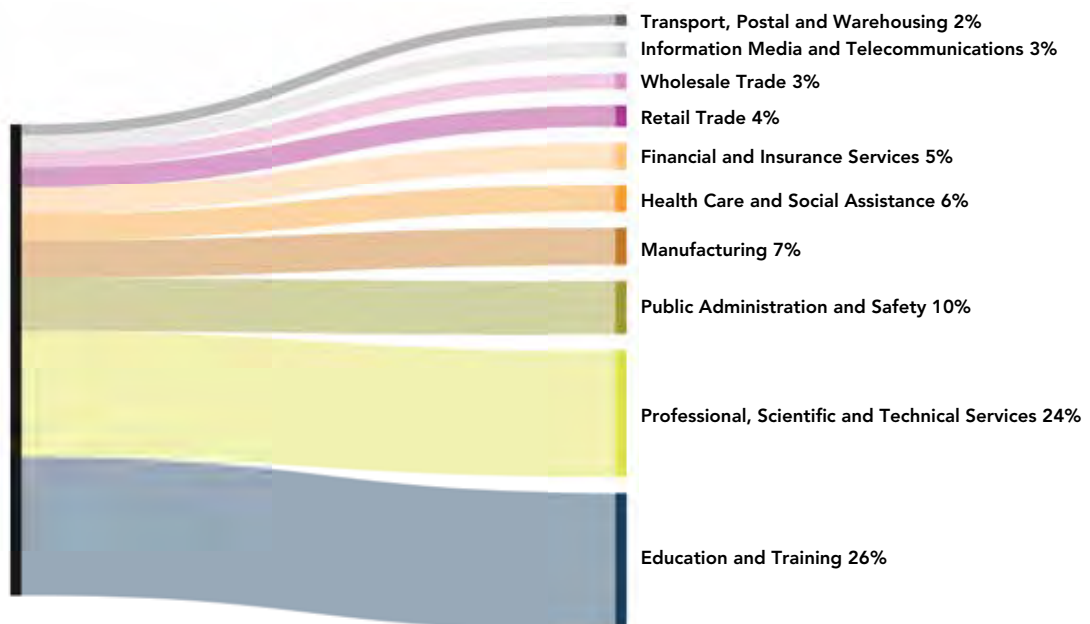
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## STEM PATHWAYS: PHYSICS AND ASTRONOMY

### KEY FACTS

- 1** In 2011, there were 12 130 Physics and Astronomy graduates, and the majority (82 per cent) were male.
- 2** The female workforce was younger than the male workforce, where the largest age cohort for females was aged 25–34, and for males was aged 45–54 (30 and 21 per cent of each gender, respectively).
- 3** Sixty per cent of all graduates worked in the private sector—varying from 73 per cent of bachelors to 36 per cent of doctorates.
- 4** Half of all graduates worked in two industry divisions: Education and Training (26 per cent), and Professional, Scientific and Technical Services (24 per cent).
- 5** Of the doctorate holders, 39 per cent worked in Higher Education, and 13 per cent in Scientific Research Services.
- 6** The most common occupations were as professionals in Design, Engineering, Science and Transport (23 per cent), Education (14 per cent) and Information and Communication Technology (13 per cent).
- 7** Those with higher level qualifications earned more—over 1.5 times as many doctorates compared to bachelors had an annual personal income in the highest bracket (35 and 21 per cent, respectively, earned \$104 000 or above).

Top ten industry sectors of employment for Physics and Astronomy graduates



## HOW MANY PHYSICS AND ASTRONOMY GRADUATES ARE THERE IN AUSTRALIA?

In 2011, there were 12 130 graduates in the field of Physics and Astronomy. Ninety four per cent were Physics graduates, and 6 per cent were Astronomy graduates.

Thirty per cent of graduates (3606) were either not in the labour force or were unemployed (27 and 3 per cent, respectively).

Of those graduates in the workforce, just over one third had a doctorate degree (34 per cent), compared to eight per cent of STEM graduates and just three per cent of Non-STEM graduates. Males made up 82 per cent of all graduates, and 86 per cent of doctoral graduates.

## HOW OLD IS THE PHYSICS AND ASTRONOMY GRADUATE WORKFORCE?

The Physics and Astronomy workforce is distinctive in its age distribution by gender—65 per cent of females were aged 44 or under, compared with only 49 per cent of males (Figure 5.1).

## WHERE DO PHYSICS AND ASTRONOMY GRADUATES WORK?

The private sector employed 60 per cent of all Physics and Astronomy graduates; however, this percentage varied with level of qualification:

- ▶ Bachelor level: 73 per cent
- ▶ Postgraduate level: 47 per cent
  - Masters: 71 per cent
  - Doctorate: 36 per cent

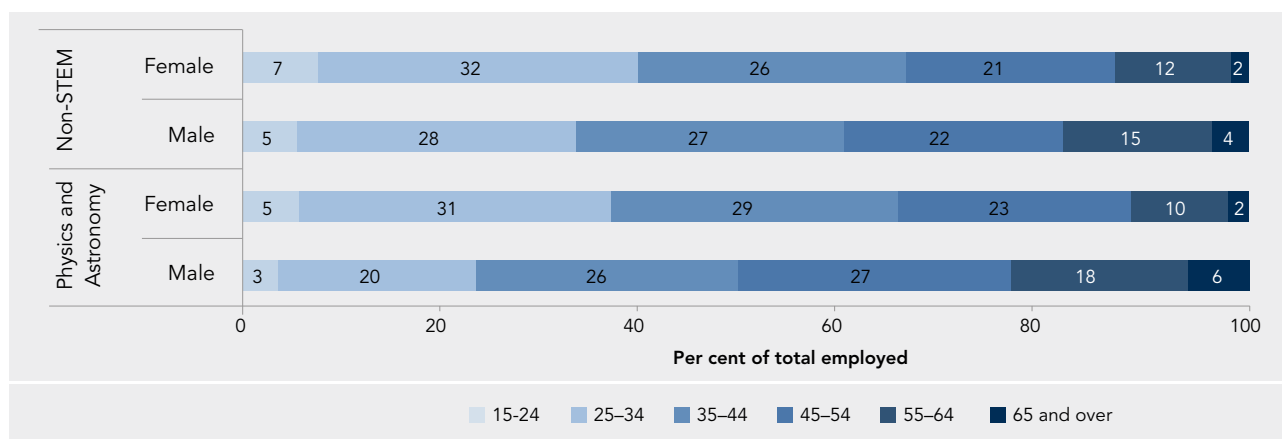
## INDUSTRY SECTORS OF EMPLOYMENT

Industries are classified in four levels (ABS, 2006a):

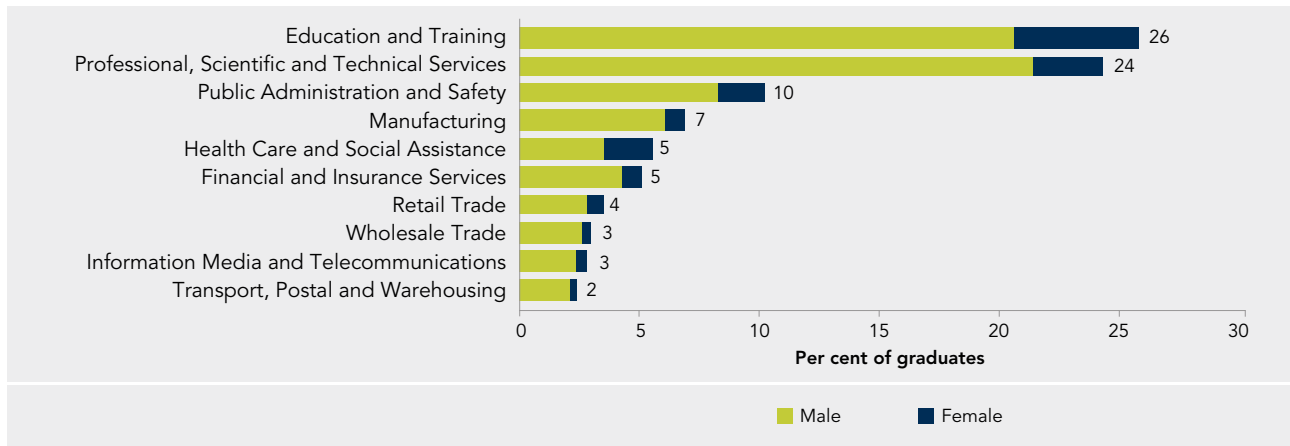
- ▶ Divisions (the broadest level)
- ▶ Subdivisions
- ▶ Groups
- ▶ Classes (the finest level)

See Appendix B for a detailed list.

**Figure 5.1: Age distribution of employed graduates with qualifications at bachelor level and above, by field and gender**



**Figure 5.2: Top ten industry divisions of employment for Physics and Astronomy graduates with qualifications at bachelor level and above, by gender**



**Figure 5.3: Top ten industry divisions of employment for Physics and Astronomy doctoral graduates, by gender**



Half of the Physics and Astronomy graduates in Australia were employed in two industry divisions: Education and Training and Professional, Scientific and Technical Services, with 26 and 24 per cent of graduates, respectively (Figure 5.2). The other 50 per cent of graduates were spread across the remaining 17 industry divisions. At the doctorate level, 43 per cent were employed in Education and Training, and one quarter (26 per cent) in Professional, Scientific and Technical Services (Figure 5.3).

Male and female graduates were employed in different proportions across industries. For example, one quarter of males worked in each of Professional, Scientific and Technical Services, and Education and Training (26 and 25 per cent, respectively), while almost one third of females worked in Education and Training (30 per cent), and only

17 per cent in Professional, Scientific and Technical Services. The industry class of Computer System Design and Related Services employed 12 males for every female (Figure 5.4). Within the Education and Training industry, 19 per cent of graduates were employed in Higher Education, and a further 3 per cent in Secondary Education.

Doctorate graduates were more concentrated in the Higher Education and Scientific Research Services (39 and 13 per cent, respectively) sectors compared to Physics and Astronomy graduates as a whole (Figure 5.5).

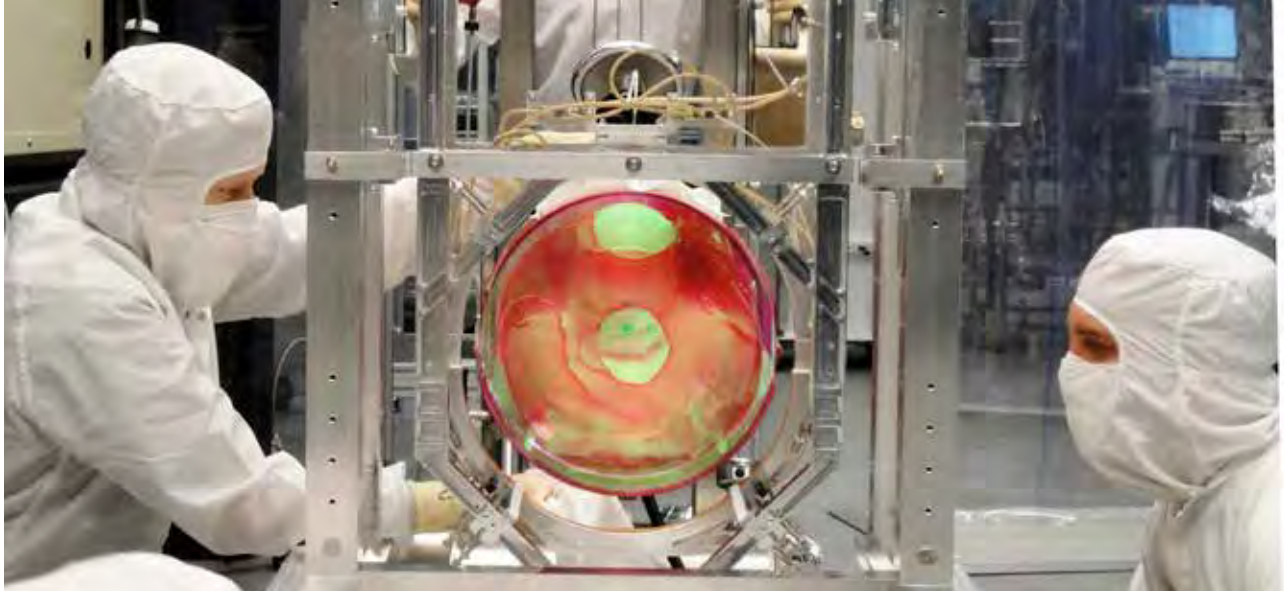


Figure 5.4: Top ten industry classes of employment of Physics and Astronomy graduates with qualifications at bachelor level and above, by gender

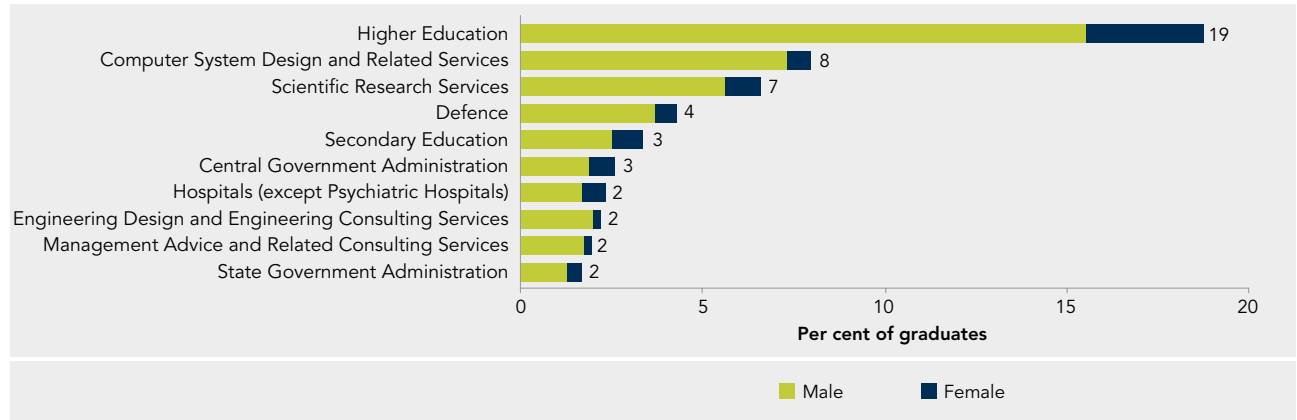
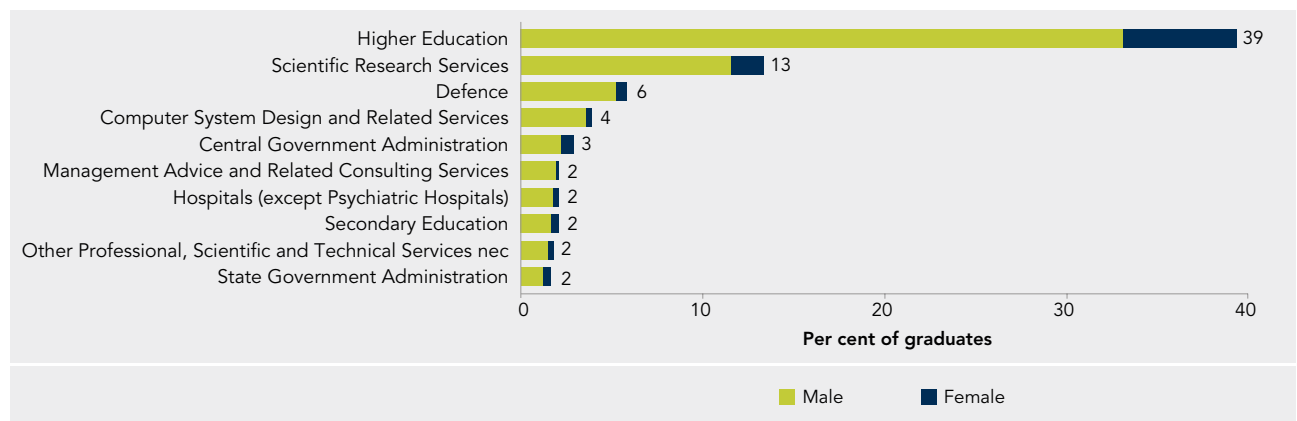
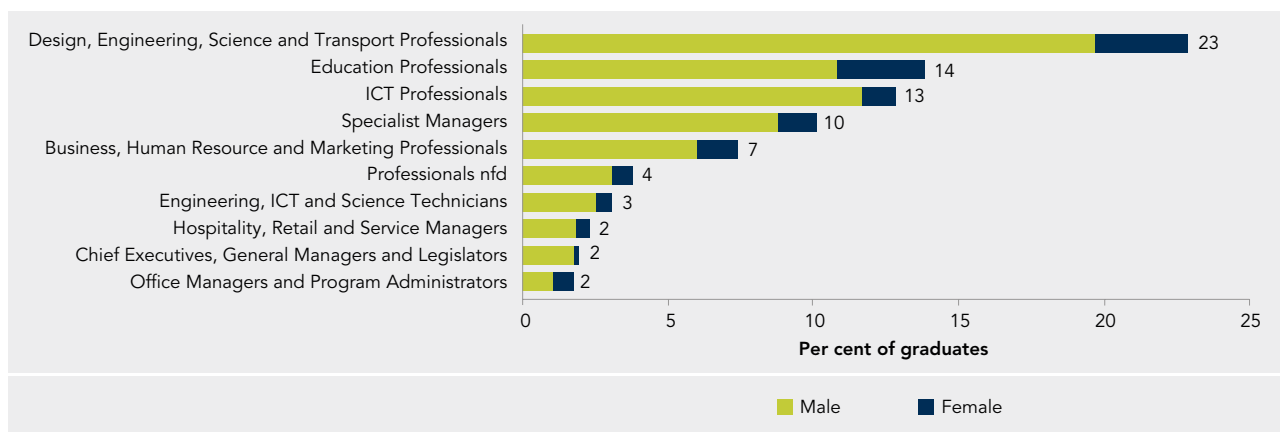


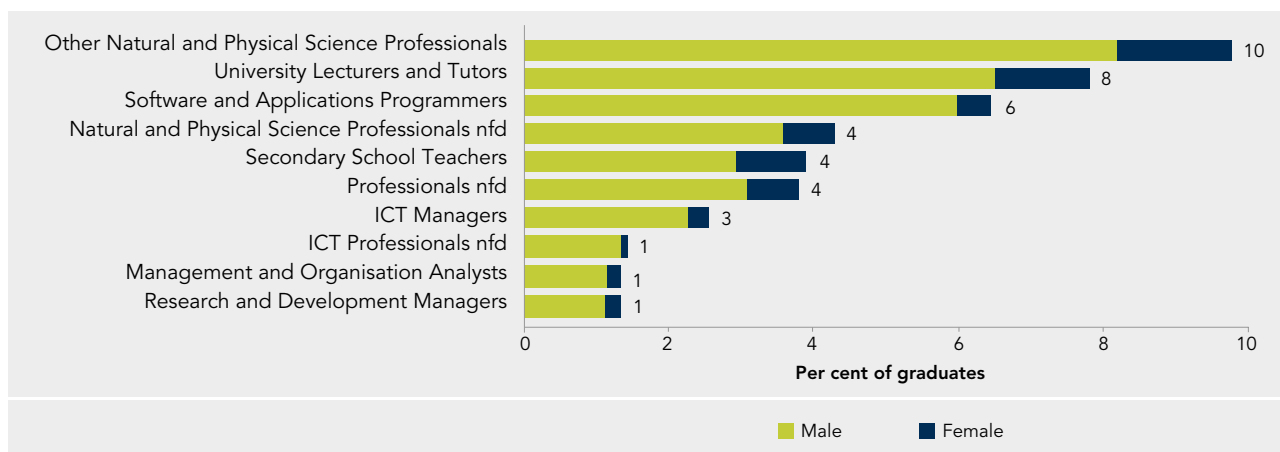
Figure 5.5: Top ten industry classes of employment of Physics and Astronomy doctoral graduates, by gender



**Figure 5.6: Top ten sub-major group level of occupations of Physics and Astronomy graduates with qualifications at bachelor level and above, by gender**



**Figure 5.7: Top ten unit group level occupations of Physics and Astronomy graduates with qualifications at bachelor level and above, by gender**



## WHAT ARE THE OCCUPATIONS OF PHYSICS AND ASTRONOMY GRADUATES?

Almost two thirds of all Physics and Astronomy graduates were employed in the major occupational group of Professionals (64 per cent), while 15 per cent worked as Managers (data not shown).

The most common sub-major occupations were (Figure 5.6):

- ▶ Design, Engineering, Science and Transport Professionals (23 per cent)
- ▶ Education Professionals (14 per cent)
- ▶ ICT Professionals (13 per cent).

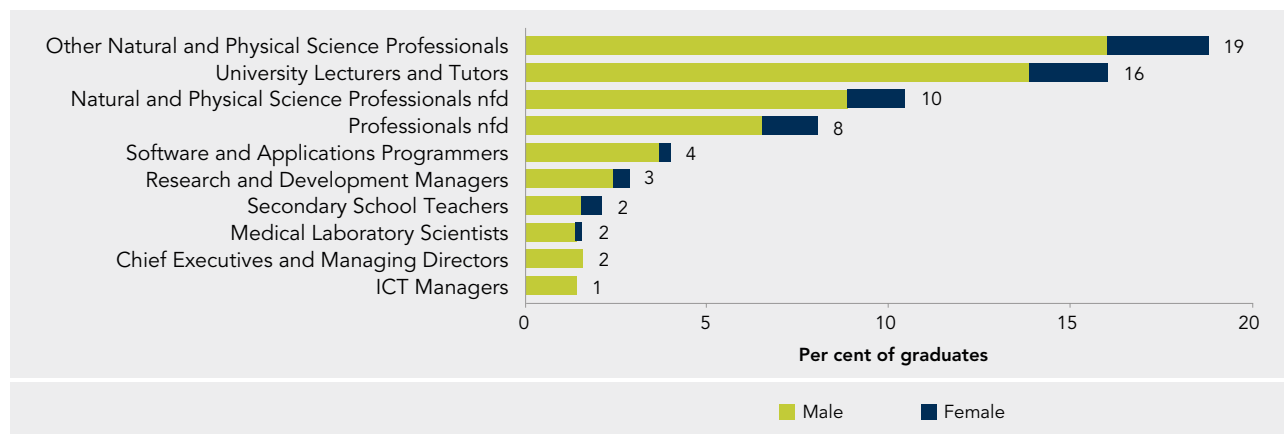
Occupations are classified in five levels (ABS, 2013):

- ▶ Major group (broadest level)
- ▶ Sub-major group
- ▶ Minor group
- ▶ Unit group
- ▶ Occupation (most detailed level)

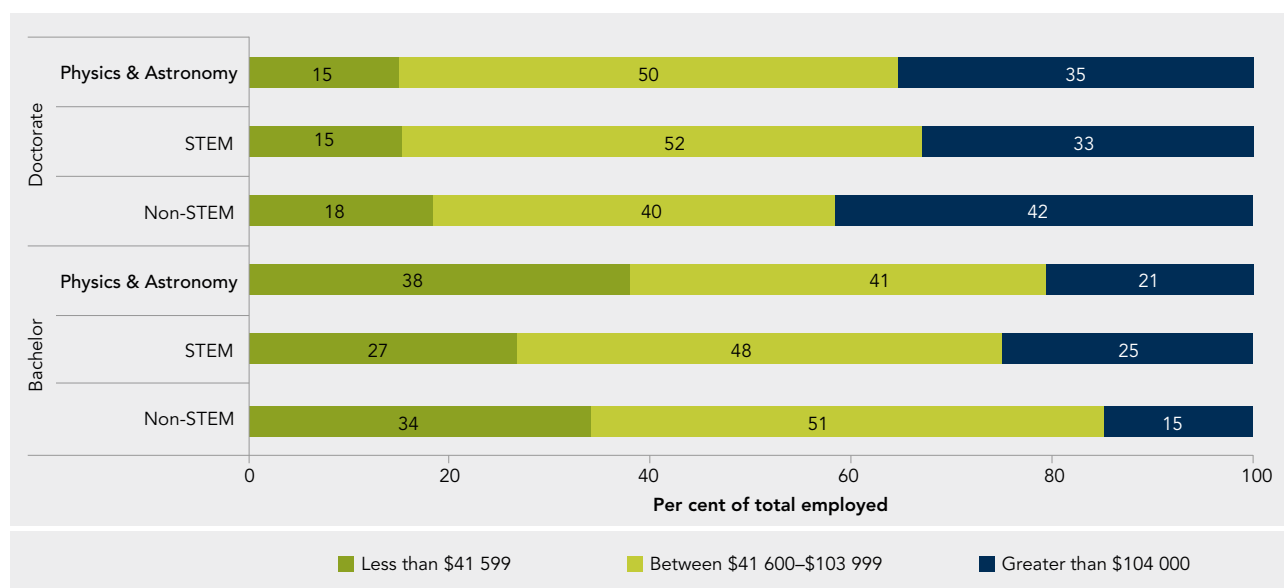
See Appendix C for a detailed list.

More males worked as ICT Professionals (14 per cent) than Education Professionals (13 per cent), while more females were employed as Specialist Managers or Business, Human Resource and Marketing Professionals (both 8 per cent) than ICT Professionals (6 per cent).

**Figure 5.8: Top ten unit group level occupations of Physics and Astronomy doctoral graduates, by gender**



**Figure 5.9: Personal annual income of graduates, by field and level of qualification**



At the unit level, the most common occupations were Other Natural and Physical Science Professionals (10 per cent), and University Lecturers and Tutors (8 per cent) (Figure 5.7).

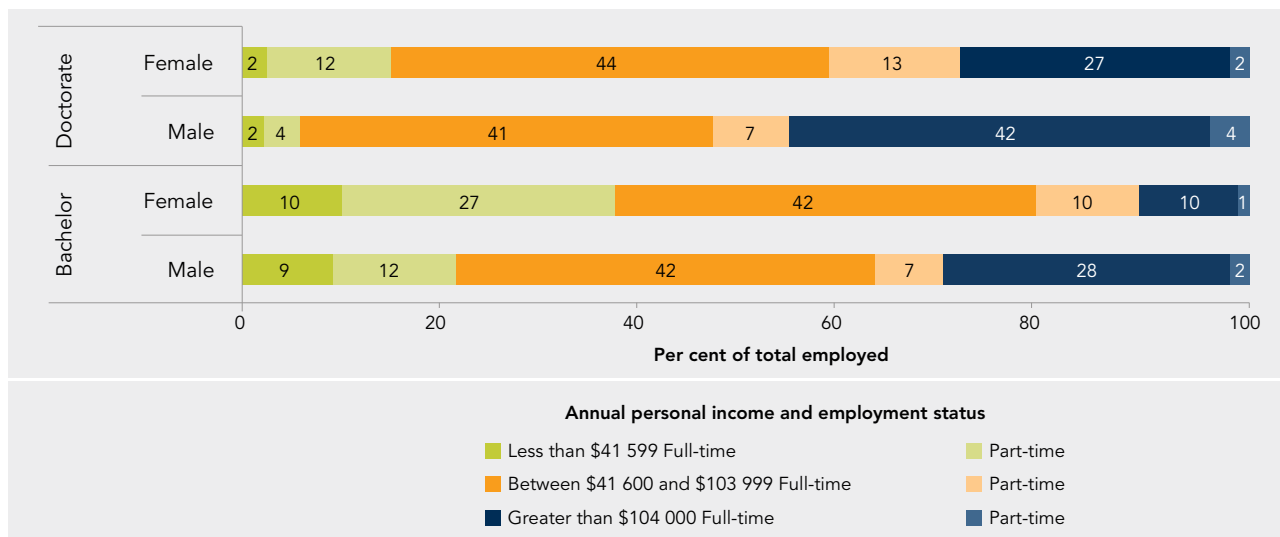
Of those who worked as Education Professionals, over half were University Lecturers and Tutors (56 per cent). ICT Professionals most commonly worked as Software and Application Programmers (50 per cent). Comparative female representation among Software and Application Programmers was the lowest of the top ten occupation unit groups (12 males for every female).

### ARE THE DESTINATIONS FOR PHYSICS AND ASTRONOMY DOCTORATE HOLDERS DIFFERENT FROM THE COHORT AS A WHOLE?

The top two occupations for doctoral graduates were the same as those at bachelor level or above—37 per cent were Design, Engineering, Science and Transport Professionals, and 19 per cent were Education Professionals.

At the more detailed unit group level, doctorate holders most commonly worked as Other Natural and Physical Science Professionals (19 per cent) and University Lecturers and Tutors (16 per cent) (Figure 5.8).

**Figure 5.10: Personal annual income of Physics and Astronomy graduates working full-time and part-time, by field, gender and level of qualification**



## ARE PHYSICS AND ASTRONOMY GRADUATES HIGH EARNERS?

At the bachelor level, a higher proportion of Physics and Astronomy graduates received an income in the highest bracket (more than \$104 000 per year) compared to Non-STEM graduates (21 and 15 per cent, respectively); however, both were lower than the percentage for the total STEM bachelor cohort, at 25 per cent (Figure 5.9).

Completing a doctorate in Physics and Astronomy can be financially rewarding: over 1.5 times as many doctorate degree holders had an income in the highest bracket, compared to bachelor degree holders in the same field (35 and 21 per cent, respectively).

A higher percentage of Non-STEM doctoral graduates had an income in the higher brackets than those from Physics and Astronomy and the total STEM cohort (42, 35 and 33 per cent, respectively); however, only 15 per cent from Physics and Astronomy were in the lowest bracket (earnings less than \$41 599), compared to 18 per cent of Non-STEM.

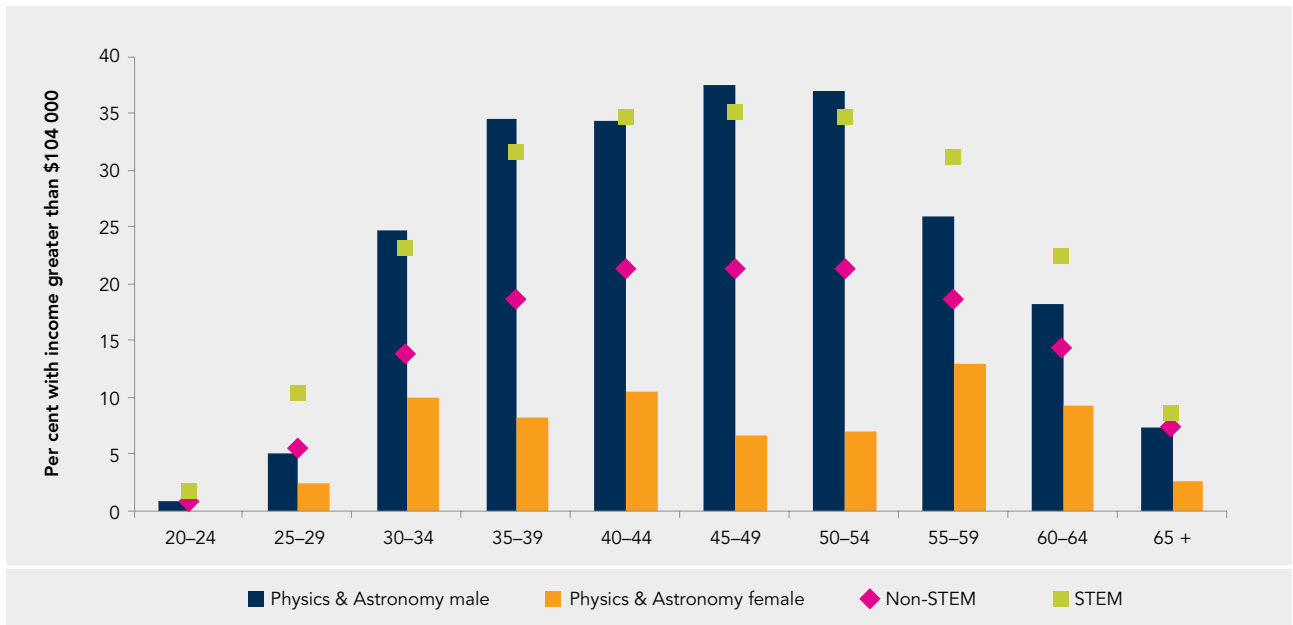
The incomes of graduates were closely related to their full-time or part-time employment status and gender; with more females and more part-time workers in the lower income brackets (Figure 5.10). At the bachelor level, 30 per cent of all male graduates earned over \$104 000, while only 11 per cent of female graduates did. Almost half (46 per cent) of male graduates with a doctorate degree were in this highest income bracket.

Age and gender are important factors in the income levels of graduates—as they are for the whole population. At the bachelor level, there was a higher proportion of male Physics and Astronomy graduates in the highest income bracket compared to Non-STEM across all age groups (Figure 5.11). The proportion of male Physics and Astronomy graduates in the highest bracket was generally comparable to that of the STEM average between the ages of 30 to 50 for bachelor graduates and higher than the STEM average for doctoral graduates between the ages of 35 to 60 (Figure 5.12).

A lower proportion of female bachelor graduates were in the highest income bracket compared to males across all age groups—the difference was at least double for all age groups, and was greatest between ages 45 to 49. At the doctoral level of qualification, the difference between males and females is less pronounced, and is reversed at the ages of 65 and above.



**Figure 5.11: Percentage of bachelor level graduates earning greater than \$104 000 annually, by field, age group and gender**



**Figure 5.12: Percentage of doctoral level graduates earning greater than \$104 000 annually, by field, age group and gender**

