### **CHAPTER 5**

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## STEM PATHWAYS: PHYSICS AND ASTRONOMY

### What is Physics and Astronomy?

Physics and Astronomy is the study of the laws governing the structure of the universe and the forms of matter and energy. The main purpose of this narrow field of education is to develop an understanding of the fundamental properties of the universe and the laws which govern its behaviour and to assess and validate physical phenomena.

-Australian Bureau of Statistics, 2001

This chapter examines the employed population in Australia with university qualifications (bachelor degree and above) in Physics and Astronomy. Comparisons to STEM and non-STEM populations are also restricted to those with university qualifications.

### HIGHLIGHTS

- In 2016, there were 14 519 people with university Physics and Astronomy qualifications in Australia. Of these, 10 069 people were in the labour force, of whom 9 502 were employed.
- 20% of Physics and Astronomy graduates in the labour force were female, an increase of 2 percentage points since 2011.
- Employed male Physics and Astronomy graduates were older than employed female Physics and Astronomy graduates, and older than the overall employed STEM qualified graduates.

- Three-quarters of employed graduates with a Physics and Astronomy bachelor degree worked in the private sector, compared to half of those with a masters or a doctorate.
- Half of all Physics and Astronomy graduates were employed in two industry divisions: Education and Training (28%), and Professional, Scientific and Technical Services (22%).
- The most common occupation for Physics and Astronomy graduates was University Lecturers and Tutors, the role held by 9% of graduates.
- Nearly a third (31%) of Physics and Astronomy bachelor graduates and over half (52%) of doctoral graduates had an income of \$104 000 or above.



## 14 519 people in Australia had a university qualification in Physics and Astronomy



### The Physics and Astronomy qualified population

In 2016, there were 14 519 people in Australia with university qualifications in the field of Physics and Astronomy, an increase of over 2 300 people from 2011.

94% were Physics graduates and 6% were Astronomy graduates.

### The Physics and Astronomy labour force

Of the qualified population, 69% (10 069 people) were in the labour force, either working or looking for work. In 2016, females made up 20% of the Physics and Astronomy labour force, an increase of 2 percentage points from 2011.

The unemployment rate in this field was 5.0% for males and 7.9% for females, up from 4.1% and 6.5% in 2011.

Just over one-third (34%) of Physics and Astronomy graduates in the labour force had a doctorate—the highest percentage of doctorates in all of the narrow fields of Natural and Physical Sciences. In comparison, only 7% of STEM graduates in the labour force and 3% of non-STEM graduates in the labour force had doctorates.

The gender split of Physics and Astronomy doctorate holders in the labour force (85% male, 15% female) was unchanged from 2011.

### **Employed Physics and Astronomy graduates**

In 2016, on Census night, 9 502 university qualified Physics and Astronomy graduates were employed. The remainder of this chapter takes a closer look at these employed graduates.

# How old is the Physics and Astronomy graduate workforce?

In 2016, male Physics and Astronomy graduates were noticeably older than the comparative populations of female Physics and Astronomy graduates, and the overall STEM populations of both genders.

While the majority of employed male Physics and Astronomy graduates were aged 45 and over (52%), the majority of employed female graduates were younger than 45 (63%; Figure 5.1). The majority of the overall employed STEM populations of both genders were also younger than 45.





# Where do Physics and Astronomy graduates work?

In 2016, 75% of employed people with a Physics and Astronomy bachelor degree worked in the private sector, compared to 50% of those with a masters or a doctorate (data not shown).

#### INDUSTRIES OF EMPLOYMENT

As was outlined in Figure 4.11 (Chapter 4), half of employed Physics and Astronomy graduates worked in two industry divisions in 2016: Education and Training (28% of graduates) and Professional, Scientific and Technical Services (22%). The remainder were spread across the other 17 industry divisions (Figure 5.2). This distribution is similar to that in 2011, when 26% of employed graduates worked in Education and Training, and 24% in Professional, Scientific and Technical Services.

#### Industries are classified in four levels:

- Divisions (the broadest level)
- Subdivisions
- Groups
- Classes (the most detailed level)

Compared to the whole cohort, doctoral graduates were more concentrated in Education and Training, with almost half of those who were working employed in this division (47%; Figure 5.3). These industries and proportions were similar in 2011.

## Figure 5.2: Top ten industry divisions of employment for Physics and Astronomy graduates with university qualifications, by gender



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



Further analysis showed that a greater proportion of female graduates than male graduates were employed in the Education and Training division, which employed around one-third of working females with Physics and Astronomy qualifications, and one-quarter of working males (32% and 27% respectively). In comparison, the Professional, Scientific and Technical Services division employed 15% of female graduates and around one-quarter of male graduates (data not shown).

At the most detailed industry level, the largest industry class was Higher Education, where one-fifth of employed graduates (20%; Figure 5.4) and 41% of doctoral graduates (Figure 5.5) worked. The next most popular industry class for doctoral graduates was Scientific Research Services, which employed 11% of this cohort. Figure 5.4: Top ten industry classes of employment of Physics and Astronomy graduates with university qualifications, by gender



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



# What are the occupations of Physics and Astronomy graduates?

In 2016, the majority of Physics and Astronomy graduates were employed in the major occupational group of Professionals (61%), while Managers was the second most common occupation, at 15% (data not shown).

Occupations are classified in five levels:

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

The more detailed sub-major occupations reflect this distribution of graduates, with almost half of all working graduates employed as professionals in three sub-major occupations: Design, Engineering, Science and Transport Professionals (19%), Education Professionals (15%), and ICT Professionals (13%; Figure 5.6). The most common sub-major occupation for females was Education Professionals (18% of females), while for males was Design, Engineering, Science and Transport Professionals (20% of males).

# Figure 5.6: Top ten sub-major group level occupations of Physics and Astronomy graduates with university qualifications, by gender



Analysis of occupations at the unit group level gives an even more detailed picture. In 2016, the most common unit group occupation for both bachelor and doctoral graduates was University Lecturers and Tutors (Figure 5.7 and Figure 5.8).

# Are Physics and Astronomy graduates high earners?

In 2016, Physics and Astronomy bachelor graduates earned less than STEM qualified bachelor graduates, while those with a doctorate earned more than STEM qualified doctoral graduates.

The highest annual income bracket in the 2011 Census was \$104 000 or above. In the 2016 Census, the highest income bracket was increased to \$156 000 or above. To enable comparisons to the previous report, the \$104 000 or above income bracket is maintained in this report.

Nearly a third (31%) of employed Physics and Astronomy bachelor graduates had an income in the highest bracket of \$104 000 or above, which was a larger percentage than the non-STEM qualified cohort, but less than the STEM qualified graduate cohort (Figure 5.9). At the other end of the income scale, approximately a quarter (26%) of employed Physics and Astronomy bachelor graduates had an income in the lowest bracket (less than \$41 600), an increase of 1 percentage point since 2011. Figure 5.7: Top ten unit group level occupations of Physics and Astronomy graduates with university qualifications, by gender



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



Income is closely related to gender and full-time or part-time employment (Figure 5.10). Substantially more male than female bachelor graduates had an income in the highest bracket, at 35% and 14%, respectively. Of those with doctoral degrees, over half of males (56%) were in the highest bracket, compared to just 37% of females with the same level of qualification. A greater proportion of males worked full-time than females, increasing their capacity to earn in the highest bracket. 78% of male bachelor graduates and 85% of male doctoral graduates worked full-time, compared to 57% of female bachelor graduates and 74% of female doctoral graduates.





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



Along with gender, age is also an important factor in the income levels of graduates. Among bachelor graduates, those aged 45 to 49 had the largest percentage of workers earning in the highest income bracket (49% of males and 24% of females; Figure 5.11). For all age brackets over age 35, more than double the percentage of males than females were in the highest income bracket.

For those with doctoral qualifications, the proportion of males earning in the highest bracket peaked at the same age as for bachelor graduates (45 to 49). The female peak was at age 50 to 54, where a similar proportion of males and females earned \$104 000 or above (Figure 5.12). The differences between the proportions of males and females in the highest bracket across all age groups were generally smaller for those with doctoral qualifications compared to those with bachelor qualifications.

# Figure 5.11: Percentage of bachelor degree graduates with an income of \$104 000 or above, by field, age group and gender





