School of Physics Gender Ratio Report

Written by Chris Herron – November 2015

Introduction

The School of Physics Equity and Access Committee (PEAC) at The University of Sydney was established to ensure that the School of Physics provides an equitable workplace environment that is supportive of all staff and students, to raise awareness of equity, access and diversity issues within the School, and provide advice to staff and students within the School regarding equity, access and diversity issues. To help construct an equitable workplace environment, and to inform the creation of gender targets for the School, I have investigated the gender ratio (number of women divided by total number of people) of staff and students in the School of Physics.

Studying the gender ratio of staff and students over time will allow PEAC to monitor the number of women in the School of Physics and allow the School to decide if its policies encourage women to study or work in the School. These data will also illustrate the environment in the School over time and provide necessary context for the creation and future adjustment of gender ratio targets.

Additionally, from this data PEAC will be able to study the gender ratio profile (gender ratio across academic levels, in a given year) of the School of Physics. These profiles will aid in determining whether women are more likely to leave academia than men, as they progress through their careers. Any biases present in the promotion process may also create observable signatures in these profiles.

In this report I describe how gender ratio data for the School of Physics was acquired, and present both the gender ratio of the School between 2003 and 2015, and the gender ratio profile of academic staff for years between 2008 and 2015. I discuss the gender ratio data in terms of how the staff gender ratio could be improved, and make short- and long-term recommendations for how PEAC can improve the gender ratio in the School of Physics.
Data Acquisition

For the years 2003, 2005, 2006 and 2007, the School of Physics staff lists provided in the Faculty of Science Handbooks\(^1\) were transcribed, and a gender was assigned to each listed staff member based on the first name of the staff member. In cases where the gender of the staff member was uncertain, members of PEAC who knew the staff member were contacted, and their gender confirmed. The position of each staff member as listed in the Handbooks was used to determine whether the member was academic or professional.

For 2008 – 2014, The University of Sydney HR Service Centre provided gender ratio statistics. For these years, we have the number of men and women in each academic and professional level. From these data, I calculated the total number of staff, total number of male and female staff, total number of male and female staff in academic and professional positions, the total number of men and women in each academic level, and the corresponding gender ratios for all of these quantities.

For 2015, the School of Physics HR Assistant, Mr Sang Huynh provided the number of men and women in each academic level, and in professional roles. The School of Physics Administrative Assistant, Ms Alexis George provided lists of enrolled postgraduate students for 2008 – 2015.

The data are held in files Staff_Statistics.xlsx, Student_Statistics.xlsx, and Gender_Profiles.xlsx, held at http://sydney.edu.au/science/physics/restricted_docs/committees/peac/peac_data.

\(^1\) http://ses.library.usyd.edu.au/handle/2123/990/browse?type=dateissued&sорт_by=2&order=DESC&rpp=20&etal=0&submit_browse=Update (accessed 3/5/2015)
Results
Gender Ratio vs Time

A plot of the gender ratio of academic, professional, and all staff for the period 2003 – 2015 is shown in Figure 1. I find that the gender ratio for academic staff in the School of Physics has remained approximately constant at 20% for the studied period of time. I also find that the gender ratio for professional staff was approximately constant at 30% between 2003 and 2010, however has since rapidly grown to almost 50% at present. This level has been maintained since 2013, implying that the gender ratio for professional staff has achieved short-term stability. The cause of this rapid increase in the gender ratio of professional staff, followed by a plateau almost at 50%, is likely related to the establishment of Australian Research Council (ARC) Centres of Excellence (CoEs) within the School of Physics. The establishment of these CoEs has led to the hiring of additional professional staff members to maintain the CoEs.

Figure 1: The gender ratio for the School of Physics from 2003 to 2015, for all staff (blue), academic staff (red), and professional staff (green).
In Figure 2 I plot the total number of female staff, as well as the number of female academic and professional staff, and in Figure 3 the corresponding plots for male staff. This plot demonstrates that the number of female professional staff has increased over the last decade, particularly from 2010 to 2013, and this is the primary cause of the increase in the total number of female staff in the School of Physics. The number of female academics shows a weak general increase over the last decade, although this is mainly due to the hiring of five additional female staff members between 2014 and 2015. The number of female academics also shows a vaguely periodic pattern, wherein the number of female academics increases suddenly, then slowly declines for the next two years, and then increases suddenly again. If this pattern is real, and not a statistical anomaly, then the number of female academics in the School of Physics will decrease over the next two years.

The number of male academic staff has increased regularly since 2003, and the number of male professional staff remained close to 20 between 2003 and 2015.
In Figure 4 I plot the gender ratio of the different academic levels, from Level A (early-career researcher) to Level E (professor), as a function of time between 2008 and 2015. For Level A academics (dark blue), the gender ratio increased to a maximum of 31.5% in 2012, but has since dropped to 17.5% in 2015. Alternatively, the gender ratio for Level B academics (red) achieved a maximum value of approximately 27% in 2008 and 2015, but was at its lowest in 2012. These two plots suggest that the gender ratios of Level A and Level B academics are anti-correlated. For example, promoting female academics from Level A to Level B would decrease the gender ratio at Level A, and increase the gender ratio for Level B.
The gender ratios of Level C academics (green) and Level E academics (light blue) both show a general increase over the time period studied. However, the gender ratio of Level D academics (purple) shows a general decrease over this time period.

Number of Women in Academic Levels vs Time

_**Number of Women by Academic Level in School of Physics**_

- Num A Female
- Num B Female
- Num C Female
- Num D Female
- Num E Female
In Figure 5 I plot the number of women in each of the academic levels as a function of time, and in Figure 6 I give the corresponding plots for the number of men. The number of women is always small, and so any change in the position of an individual woman will cause a significant change in the corresponding gender ratio. Figure 5 also demonstrates that the number of women at Level C, D and E has gradually increased over time, but only by two to three new appointees. Furthermore, the number of women at Level D has not changed since 2010. Hence, the decline in the gender ratio for Level D is caused by the lack of women being promoted to Level D.

The number of women in Level A and B shows a similar pattern to the gender ratio for these levels. These plots demonstrate that the apparent anti-correlation between the gender ratio of women in Level A and Level B can only be explained by women in Level A promoting to Level B for the 2012 – 2013 period. For other years, a decrease in the number of women in Level A does not have a corresponding increase in the number of women in Level B. Hence, I believe that the observed anti-correlation between the gender ratios
for Level A and Level B is a statistical anomaly, brought about by the low-number statistics present in the data.

The number of men at levels A and D has increased between 2008 and 2015, whereas the number of men at levels B, C and E has fluctuated with little net change.

**Gender Ratio Profiles**

![Graph showing gender ratio profiles](image)

*Figure 7: The gender ratio profile of academics in the School of Physics for various years. 2008 (dark blue), 2009 (red), 2010 (green), 2011 (purple), 2012 (light blue), 2013 (orange), 2014 (pastel blue), 2015 (pink).*

In Figure 7 I plot the gender ratio profile for each year between 2008 and 2015. There is significant variation in these plots, particularly at Level A and Level B. Because of these variations, there is no clear trend in these profiles for all of the studied years. For example, in 2009 there is a general decrease in the gender ratio from Level A to Level E, however in 2010 and 2011 there is an increase in the gender ratio from Level B to Level E. From 2012 to 2015, there is no general trend.
There may not be a clear trend in any individual year because of low-number statistics, and so in Figure 8 I present the mean and median gender ratio profile, where the mean and median are calculated at each academic level over the 2008 to 2015 period. This procedure should be reasonable for Level C, D and E, since there has been little variation in the gender ratio of these levels over the studied time period. This procedure is less rigorous for Level A and B, as the gender ratio of these levels do vary significantly with time. Bearing this in mind, the average gender ratio profile shows a weak decrease from Level A to Level D, however the median gender ratio profile does not show any trend. Hence, I conclude that the gender ratio profile data for the School of Physics does not show any clear trend for the years studied.

Figure 8: The average gender ratio profile of academics in the School of Physics (green), and the median gender ratio profile (purple).
Number of Women Academic Profiles

Figure 9: The number of female academics in each academic level, for different years. 2008 (dark blue), 2009 (red), 2010 (green), 2011 (purple), 2012 (light blue), 2013 (orange), 2014 (pastel blue), 2015 (pink).

Number of Men - Academic Profile

Figure 9: The number of male academics in each academic level, for different years. 2008 (dark blue), 2009 (red), 2010 (green), 2011 (purple), 2012 (light blue), 2013 (orange), 2014 (pastel blue), 2015 (pink).
In Figure 9 I plot the number of women in each academic level for different years, Figure 10 gives the corresponding plots for the number of men. From these plots, I find that in general, there are more women and men at lower levels than higher levels. This is to be expected, as there are fewer positions available at higher levels. However, in every year there are more women in Level E than at Level D, which could either indicate that women in Level D promote to Level E quickly, or that there have been few promotions to Level D in recent years.

**Discussion**

There has been very little change in the gender ratio of academic staff in the School of Physics over the past decade, although the overall number of female academics has increased. This implies that the current workplace environment, and current hiring policies, have not provided any extra incentive for women to enter, leave, or continue to pursue academia. There has also been little change in the gender ratio of each academic level since 2008, as the gender ratio tends to fluctuate around 20%. These fluctuations are largest for Level A and Level B, which do show significant changes each year that are probably caused by new appointments and promotions. Correspondingly, the gender ratio profile of the School of Physics does not exhibit any systematic changes from year to year, and instead shows fluctuations that are likely related to hiring and promotion at Level A and B.

From these gender ratio profiles, and the average and median gender ratio profile, I find that there is little difference in the gender ratio of different academic levels. These profiles are significantly different to the profile shown in Bell (2009)² for the natural and physical sciences, where it was found that the gender ratio was approximately 50% at Level A, and decreased monotonically towards Level E. The

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same trend was found with data from 2011\(^3\), which is shown in Figure 11. Bell (2009) suggested that the trend seen in Figure 11 is caused by barriers to the academic progression of women, wherein women are more likely to discontinue study in Science because of unconscious biases in hiring and promotion, discrimination, or family-unfriendly workplaces.

![Gender representation by student completions and academic level, natural and physical sciences, 2011](image)

**Figure 11:** The gender ratio profile of natural and physical sciences. Females (blue), males (red). Copied from [3].

This cannot explain the data we have found for the School of Physics, as a constant gender ratio profile implies that men and women are equally likely to discontinue study at the School of Physics. I believe that this finding differs from the findings of Bell (2009) because I am only examining academics in Physics, whereas Bell (2009) used combined data for all scientific disciplines, some of which have larger gender ratios for early-career researchers than Physics.

Instead, our data suggest that barriers to academic progression at or after the postdoctoral level do not cause the low number of female academics. The low number of female academics may be caused by women choosing to not study Physics at the undergraduate or postgraduate level, which in turn may be caused by low numbers of women studying Physics at the high school level. Given that the gender ratio of HSC physics is typically between 20% and 25%, the latter appears to be plausible.

More women will study Physics only if they are interested in Physics, and feel comfortable pursuing their interest in Physics. Thus, to achieve an increased gender ratio at all levels of academia, and perhaps one day a 50% gender ratio, it is imperative to spark an interest in Physics, and in Science in general, to children at a young age. It is also important to encourage female high school students to study Physics and Science. Possible means of accomplishing this include:

- Encouraging parents to take their children to museums
- More after-school TV shows related to Science
- More scientific topics in the primary school curriculum
- More programs where academic researchers talk to primary and high school students, and ensure that many academics in the program are female.
- More female teachers of Physics and Maths at high school level

Achieving these tasks should help to shift societal perception of Physics and Science, and lead to more women studying Physics.

These are all long-term (~20 years) methods of increasing the number of female academics in Physics. In the short-term, the School of Physics can work on establishing an equitable environment where everyone feels welcome, and can monitor gender ratios to look for improvement caused by long and short-term strategies. This will allow policies that have encouraged women to study Physics to be identified, and ensure that women entering Physics will feel welcome.

To aid in monitoring gender ratios, I suggest that the School of Physics should conduct a School census on the 31st of March each

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year (to coincide with the census date of the University of Sydney), and record the following information for each staff member:

- Full Name
- Preferred Name
- Gender
- Age
- Academic/Professional
- Academic/Professional level
- Date of last promotion application (or other promotional information)
- Date appointed

Gender ratios should also be recorded for post-graduate and Honours students at this time, from lists of the student’s names, gender, and what research group within the School they are associated with. Student’s names, gender, and degree should be recorded for all undergraduate classes, so that gender ratios can be calculated for each class. These statistics could also be directly obtained via the ‘Know Your Students’ service provided by the University of Sydney.