CAASTRO's Path to Gender Equality: How one question changed everything

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Centre for Ethical Leadership

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1. Introduction

Years of chatter among senior astronomers about an Australian Research Council (ARC) Centre of Excellence had finally become concrete. A self-selected proposal team had been meeting for a year and a half, and a Director had been selected; Bryan Gaensler, a former Young Australian of the Year (1999) who had held an associate professorship at Harvard University before returning to Australia in 2006 as an ARC Federation Fellow. The initial Expression of Interest to the ARC had successfully progressed to a 500 page proposal, and now, in May 2010, they had reached the final interview stage. Two weeks out they were meticulously prepared and rehearsed. All that remained was to craft responses to the questions provided in advance by the ARC and their external reviewers.

One of those questions changed everything.

"There are a very small number of women lead investigators in the proposal. Two from 12 in the Chief Investigator list, one in 12 from the Partner Investigator list, and three of nine in the Associate Investigator list. How do you propose to increase women's participation at the senior level?"

The numbers were indisputable. Women were woefully under-represented among the Centre's proposed senior staff, and the pitch had not mentioned gender or diversity anywhere in its 500 pages. Worse still, the executive team attending the interview was entirely male.

> Obviously it wasn't a good look to be asking this question with five dudes sitting there all lined up. (Professor Bryan Gaensler)

Bryan knew how it had happened. Of course it hadn't been deliberate – these things almost never are. No one in the proposal team was hostile to women; a number of the members were women who had reached the highest levels in their field and had worked for decades to improve opportunities and outcomes for women in astronomy. No, the problems arose from more unconscious and endemic sources than hostile sexism. The proposal had come together organically; people got involved simply by turning up, and for the first year of discussions no one had been in charge. An organic process is often an unconscious process and gender just hadn't come up. This was not unusual. The culture in astronomy at the time deemed the under-representation of women a niche or special interest issue, as evident in the 2006-2015 decadal plan for Australian astronomy which mentioned gender in the following lines on page 21.

> "The gender balance of Australian astronomy has improved over the past decade, with 20% of positions being held by women in 2005, up from 11% in 1995. Currently 37% of postgraduate students are female, up from 15% in 1995" (National Committee for Astronomy, 2005, p. 21).

Even had the proposal team consciously considered its gender balance, structural issues within the field of scientific research would have been a significant barrier to improving the numbers of women in leadership roles in the proposed centre of excellence for all-sky astrophysics.

> At the time there were a lot of women at level B and the ARC had emphasised over and over and over again that track record is everything and you couldn't have any junior people, they all had to be big silverbacks. And so, at the time, in 2010, if you were only going for full professors, there was only four women in the entire country. (Professor Bryan Gaensler)

Although the proposal's oversight had been understandable, perhaps even inevitable, Bryan felt chagrin at the lack of conscious effort to avoid gender inequality. Until 2003 he hadn't really cared about gender equality at all – "My view was that I didn't see gender, I treated everybody equally, and if everyone else treated everyone equally there wouldn't really be a problem". In 2003, seven years before the CAASTRO proposal was submitted, Bryan had sat on a graduate admissions committee for Harvard. They had hundreds of applications and just 10 spots to fill. All 10 PhD positions were given to men and Bryan didn't think anything of it until a few months later when he was invited to attend a women-in-astronomy lunchtime event.

> I went along and I asked, "I'm on the graduate admissions committee and we admitted 10 men and no women. How can we help women write better applications?" I thought I was going to get points for turning up to this thing and showing that I cared, but there was just silence in the room. (Professor Bryan Gaensler)

The icy silence was broken when someone asked Bryan how many women had been on the admissions committee (none), and whether he was aware of the studies showing that all-male panels tend to make all-male selections. That was Bryan's lightning bolt moment.

> It had never occurred to me that you could do research, quantifiable scientific research, on these topics. A friend took me aside after the meeting and suggested that in the same way that I wouldn't wade into some scientific topic that I know nothing about, that I actually got educated before I commented or tried to do anything about this again. (Professor Bryan Gaensler)

He took his friend's advice and began to explore the literature. He found it surprisingly rich, and began to speak out about the evidence and the gender inequality he had himself observed.

> … but I wasn't actually changing anything because I had no way of doing so. I was just one professor with my students. But I always said to myself, when I'm running the show there are simple things that I can do that will make a difference. When I'm a director of something I'll change things. But if I look at the two page summary that I submitted making the case as to why I should be director of the Centre of Excellence, I don't think there's anything in that statement whatsoever about demographics or

> inclusion or transforming the field. So even at that point it clearly wasn't a high enough priority to me. (Professor Bryan Gaensler)

That interview question made it a priority. What could they do in two weeks to convince the ARC that they were seriously taking this on board? Their long-awaited Centre was at stake. And for Bryan, it was time to actually walk the talk.

At that interview in July 2010, the executive team presented a three-point plan to address its gender imbalance and made promises to the panel to see it through. It worked, and in July 2010 it was announced that the ARC Centre of Excellence in All-Sky Astrophysics (CAASTRO) would go ahead.

Over the next seven years, CAASTRO would transform itself from an organisation with no women at a senior level, to one with women in more than half of its leadership roles. This case study outlines the actions responsible for that transformation, and the way in which it has contributed to CAASTRO's productivity. Key learnings are identified and consideration given to their capacity to transfer to other science enterprises intent on addressing diversity challenges.

2. Background to company, industry and competitors

The Australian Research Council funds Centres of Excellence with the goal of bringing together world class research teams to investigate challenging problems of national priority. They are typically funded for up to seven years and are intended to facilitate a high level of collaboration between outstanding researchers within Australia and overseas on both comprehensive research programmes, and short-term projects (Australian Research Council, 2016).

CAASTRO embodied this commitment to collaboration with nodes at six universities across Australia, and partnerships with more than 10 domestic and international research facilities.[1] When the Centre opened its doors in 2011, its Executive comprised Professor Bryan Gaensler as Director and leader of the University of Sydney node, Professor Lister Staveley-Smith as Deputy Director and University of Western Australia Node Leader, Professor Steven Tingay as leader of Outreach programs and the Curtin node, and Kate Gunn in the role of Chief Operating Officer. The leaders of each of CAASTRO's three research themes were also members of the Executive; the Evolving Universe theme, led by Professor Stuart Wyithe, the Dynamic Universe theme led by Professor Matthew Bailes, and the third theme, the Dark Universe, was then led by Professor Brian Schmidt[2].

Organised around these three themes, the Centre's vision and mission have been:

> To be the international leader in wide-field astronomy, positioning Australia to address fundamental unsolved questions about the Universe with dramatic capabilities of next-generation telescopes and advanced instrumentation.
>
> To carry out key science with 21st century telescopes with the goals:
>
> **Discover:** To make ground-breaking advances in our understanding of the Universe, thereby cementing Australia's reputation as a world leader in astrophysical research;
>
> **Innovate:** To develop innovative new ways of surveying the entire sky, processing enormous volumes of astronomical measurements, and visualising complex data sets, so as to build unique expertise in wide-field radio and optical astronomy;
>
> **Perform:** To make high-impact discoveries using SKA (Square Kilometre Array) pathfinder telescopes, thus positioning Australia to lead the science programmes planned for the SKA;
>
> **Educate:** To provide compelling new opportunities for students and early-career researchers and exciting stories to inform the public; and

[1] CAASTRO nodes: The University of Sydney, The University of Western Australia, The University of Melbourne, Swinburne University of Technology, The Australian National University, and Curtin University. The University of Queensland became a seventh node in 2013.

[2] See Exhibit 1 – Key Players, for more information on the members of the Executive.

> **Unite:** To bring the top astronomers from Australia and around the world together into a focused collaborative environment.
> (CAASTRO Web Page)

By the end of its first year of operation, CAASTRO had over 90 members, including 20 research staff and more than a dozen PhD students. Most of the projects that had been planned in the proposal phase were underway, and the Executive had started making inroads on their gender promises to the ARC (CAASTRO, 2011).

3. Issues & Challenges

While senior Australian researchers were formulating their vision for a Centre of Excellence, a cultural shift was underway in astronomy. Women like Professor Elaine Sadler, Professor Rachel Webster, Professor Anne Green, Professor Sarah Maddison, and many others had been working for decades to raise awareness of gender inequality in astronomy, and the tide was finally beginning to turn.

> Around 2009, there was a realisation within astronomy that we were being held back by issues around gender, especially with respect to promotion, advancement, and retention … There was a broad groundswell, especially amongst postdocs, essentially saying we're not going to take it anymore. And twitter I think helped a lot … People I admired and trusted were telling stories about gender challenges. (Professor Brian Schmidt)

The issues being aired around promotion, advancement, and retention, had contributed to the persistently low number of women in paid positions in astronomy. Although approximately 33% of astronomy PhD graduates were women, female participation in the workforce had been hovering stubbornly around 20% for many years (National Committee for Astronomy, 2015). Astronomy was not alone in this. Women were leaving science at alarming rates. Although comprising more than half of science PhD graduates and early career researchers, they made up only 17% of senior academics (Australian Academy of Science).

> The loss of so many women scientists is a significant waste of expertise, talent and investment, and this impacts our nation's scientific performance and productivity (Australian Academy of Science).

This under-representation of women at senior levels was the result of numerous interacting factors that could be broadly be categorised as;

1. Pipeline problems – factors deterring women and girls from pursuing careers in astronomy
2. Problems associated with caregiving – ways in which the academic career structure disadvantages those with caring responsibilities, in a social context in which women still provide the majority of unpaid care (Australian Bureau of Statistics, 2015).
3. Problems of engagement – factors contributing to the lack of involvement with, and motivation to address, gender equality issues.

Pipeline problems

Women already enter STEM fields at significantly lower rates than men (Ceci, Williams, Ginther, & Kahn, 2014). Many women are deterred at the primary, high school, or undergraduate level by

stereotypes around boys' and girls' aptitude for maths and science, and what a 'real' scientist looks like.

> When I was at school … the subtle message was that science isn't very ladylike and there was very much the push towards the arts. I like heels and I like wearing make-up and I also like doing astrophysics. And you get tons of messages during undergrad that that's not an appropriate mix." (Female PhD student)

> (Senior women academics) surveyed our first-year students to find out why they weren't going to go on in physics. Because we were having maybe a hundred students go on into second year, of whom less than 20 would be women. And we got two messages. One was that physics was hard, and the second was that girls weren't good at physics. (Professor Rachel Webster)

For those who do defy the stereotypes and pursue a career in astronomy the continued over-representation of women among primary caregivers of young children provides its own set of deterrents and obstacles.

Problems associated with caregiving

There are a number of ways in which the academic career structure disadvantages those with caring responsibilities. While this can, and increasingly does, affect men as well, the primary caregivers of young children are still overwhelmingly women (Australian Bureau of Statistics, 2015).

The competition in academe is fierce. A talented PhD will anticipate completing two or three highly contested, fixed term postdoctoral contracts, at least one overseas ideally, before being considered for a scarce associate professorship. Progress at each of these stages is greatly dependent on the volume of work published in peer-reviewed journals, and the capacity to network with senior researchers who will provide letters of reference for future appointments. Starting a family typically results in a significant career interruption for women at the critical postdoctoral stage.

> During these past five years since I moved to Australia I had two kids … So my postdoc has been a year on, a year off, a year and a half on, a year off … So I haven't really gotten to know the Australian astronomical community until this year. (Female postdoctoral researcher)

Those who return to their careers and combine caring with research battle the perception that the postdoctoral period is "an important time to be focused and strategic and women with children have too many things on their minds" (comment from a senior male astronomer). This is not too far from the reality of remaining competitive in the field while meeting caring responsibilities.

> In our field it is common place for people to work many hours outside of traditional work hours. However as a mother with children, I am much more limited in the hours I can spend outside of work. I know in the past I have competed with applicants who have had more papers on their CV and by their own admission, work most nights and weekends to get a big publication list. As a mother, it doesn't

> matter how hard I work during work hours, I can never compete with such people as I have to look after my children. (Female postdoctoral researcher)

The unequal distribution of caring responsibilities makes it more difficult for women with children to attend conferences and meetings, reducing their visibility among their peers and their access to crucial networking and collaboration opportunities.

> For so many of my current male colleagues, it seems to be a fantastic idea to hold meetings, workshops and retreats at exotic locations. They pack their clothes, walk out the door and they are off on a work trip. For me to go on a work trip requires spending the previous weekend rearranging my life and the life of my children. I find myself forever pointing out to male colleagues that exactly the same meeting/workshop/retreat could be held in (our city), without the expense of going anywhere, and that would save a lot of issues for women with children. However, rather than moving the meetings, mostly I just get told "yes, I totally understand why you can't attend", and I have to choose not to go, and that has an impact on networking and becoming known in the field. (Female postdoctoral researcher)

It is apparent that efforts to increase the number of women at senior levels in astronomy must address the impact of caring responsibilities on women's visibility and competitiveness in the field. Consideration should also be given to the structural factors that motivate excessively long working hours and the challenges these pose to both men and women, and the effort to reduce gender inequality.

Problems of Engagement

Bryan Gaensler's story of his slow progress from understanding, to observing, to acting on gender inequality is illustrative of the difficulty in engaging men with issues of gender equality, and motivating them to act once engaged.

> Afterwards it becomes obvious that there are issues, but before you came to that realisation, especially being a white, European, middleclass male, you assume that everybody has the same privileges and opportunities that you've had for all of your life. You can be carrying on blithely unaware that these issues do exist and things need to be changed and improved. You receive anecdotal stories from people that you study with or people that you meet at conferences and this makes you aware, but it's very easy to put that aside, to do the 'few bad apples' argument – 'it's not representative of the global position'. It doesn't seem like a big problem if you're only hearing anecdotes. To have your perspective change that there's an endemic problem is difficult. (Male Associate Investigator)

In some respects, the movement for gender equality has been a victim of its own success. As the more egregious displays of sexism have become less frequent and less acceptable, the challenge has shifted to subtler and more insidious problems that are more difficult to recognise.

> I've had conversations with my friends and they sort of believe us, in an intellectual way, but not really in an emotional way. I feel like the junior men think "well, I'm not sexist". They think that the problem is solved amongst our generation and that's not the case. They think that "I'm under 30. I'm not the issue". And that is the issue – or at least an aspect of it. (Female PhD student)

CAASTRO was in the fortunate, and somewhat unusual, position of being populated from the outset by people who already had a good understanding of gender issues in astronomy. Centre Director, Bryan Gaensler, had read widely on the effects of gender inequality and was committed to addressing it. The Centre's Chief Operating Officer, Kate Gunn, had been President of the National Foundation for Australian Women (NFAW) for many years, and Chair of a national government advisory group on gender. Among the CAASTRO Chief Investigators were Professor Rachel Webster, who had long been an active supporter and mentor to young women in the field, and Professor Elaine Sadler who had recently been elected to the Australian Academy of Science, and who would be appointed Centre Director upon Bryan Gaensler's departure in 2014. Nonetheless, at the time when CAASTRO was being established, astronomy's senior ranks were still unambiguously male dominated. Women were either not entering the field in the first place, or were being held back in their career progression by interactions of the factors outlined.

With the foundation laid by senior women, and the spark provided by a new generation, the ground in Australian astronomy was fertile for change. Fertile enough that an anonymous external reviewer asked an all-male bid team how they intended to address gender in their proposed Centre of Excellence - and changed everything.

4. Actions and Outcomes

The team went to the ARC assessment interview with a three-point plan to pave the way for more women to enter their senior ranks. The first point was a commitment to **outreach**, specifically, promoting science to girls in schools. It was hoped that this would help break down the stereotypes that were deterring young women from entering the field.

> Our vision is that we would have a young woman who interacted with CAASTRO as a high school student at the start of the centre, who seven years later was a PhD student in the centre. (Professor Bryan Gaensler)

The second action in the plan was mandating that all CAASTRO postdoctoral appointments, indeed, all positions in the organisation, be offered with the option to work **part-time** to prevent women with caring responsibilities being lost from the workforce.

> I do know of lots of women in CAASTRO who have spoken about the fact that it's a welcoming environment, good with kids, and allows part-time work, and that has made it significantly easier for them to stay in the field. Those are good researchers and decision makers and they would have left if the culture hadn't been what it is. (Female PhD student)

The final measure in the 3-point plan presented to the ARC review board was a focus on mentoring.

> We had lots of junior women coming up through the field who were going to be chief investigator level in 3 or 4 years and we wanted to focus on getting them involved in the Centre and mentoring them so that as there were retirements and people leaving the Centre, that some of the more obvious candidates to replace them would be women. And that's exactly what happened. (Professor Bryan Gaensler)

> The CAASTRO policy of mentoring and encouraging women's careers has helped me – for example, I was encouraged to apply for a promotion at a time when I guess I wouldn't have considered myself ready without that pushing." (Female postdoctoral researcher)

Although this was enough to sway the ARC, the CAASTRO Executive realised there was more they could do. Outreach, mentoring and flexible work are conventional, well-used responses to gender inequality that are necessary, but not sufficient, to transform an organisation. True cultural change would require more.

Once the CAASTRO Executive had committed to offering positons part-time, it made sense to incorporate a raft of other **workplace flexibility practices**[3]. Wherever possible meetings were held

[3] See Exhibit 2 – Family Friendly Fact Sheet

between 10am and 2pm to accommodate those dropping off or picking up children. Conferences and meetings were not scheduled during school holidays, and children were welcome to attend meetings if required. The benefits of these actions have been felt by many members of CAASTRO. As flexibility in the workplace became normalised, men increasingly took advantage of the opportunity to balance their work with caring responsibilities.

> I have benefitted from CAASTRO arranging and paying for babysitters at their conferences. Meetings are generally only during the day, which allows me to participate even when I have to pick up children. (Male postdoctoral researcher)

> One of our professors came to my door about 3.30 one afternoon and he just said "I'm leaving now - going to go pick my kids up from school" and I thought "WOW....we've done it! We've actually made it OK for everyone to say 'I'm off to pick up my kids from school.'" That cultural change is so critical - that everyone believes that collecting your children is a completely normal thing to do. (Kate Gunn, Chief Operating Officer)

The CAASTRO Executive also addressed obstacles to attending the conferences and meetings that are critical to maintaining visibility and competitiveness. From 2012, the organisation offered **travel support for families**, meaning that researchers attending conferences could be funded to bring their partner or another carer for young children. CAASTRO also began providing high-quality **childcare** free-of-charge at all its conferences and large meetings.

> There's no question that women with families are disadvantaged in terms of networking or opportunities to network. We all know that if you're a mother, getting out of the house is the hardest thing, so providing that additional support makes a huge difference – and so does having that as an acceptable option. (Professor Rachel Webster)

> I can go to a conference now and participate whereas before I couldn't. I'm there. I'm at the conference, I'm participating in the sessions, I'm discussing things with people at the coffee breaks. Otherwise I'd just be sitting here in my office and I wouldn't be able to connect with the community, and to get ahead in academia you need to get out there and network and show people what you do. I don't think I would have been able to do it if they hadn't had that. (Female postdoctoral researcher)

While these actions were aimed primarily at addressing the problems associated with caring responsibilities, CAASTRO also took steps to address problems of engagement. Gender action activities of CAASTRO were initially undertaken by the Executive, however, throughout 2012 and 2013 there was a growing feeling that "we weren't getting traction on gender and we didn't have time to track these things" (Bryan Gaensler). **The decision was made to establish a Gender Action Committee (GAC) to develop strategies and monitor progress, and Professor Brian Schmidt**

stepped forward to act as Chair of the Committee[4]. In that single powerful act, CAASTRO proclaimed that gender action was so important to them that a Nobel Prize winner was going to step away from his research leadership role to chair their committee.

> Having people like Brian as part of the Gender Action Committee says this is not something for second class researchers, this is what the very best people think is a priority. It makes a massive difference. (Professor Bryan Gaensler)

At this time Professor Elaine Sadler took over from Bryan Gaensler as Centre Director, and under her leadership the Gender Action Committee mandated **targets** for female representation on organising committees, presenter lists, and attendees, for conference and workshop organisers seeking event funding. As well as increasing the opportunities provided to women, it was hoped that this would further breakdown stereotypes by increasing their visibility in the field.

> A lot of young women now say a career in the academic world is just too difficult. You've got to be too competitive, it's hard to combine with children, and so on. So for them to see people who do this and have children and continue working is really helpful. (Professor Elaine Sadler)

The first round of approved workshops under the initiative resulted in gender targets in the range of 30-40%. There were difficulties, however, in attracting women from overseas to speak and present at conferences. Although the invitation lists for these events would be evenly split between men and women, women would often decline at proportionately greater rates, leaving the final gender balance of speakers skewed in favour of men.

> There are fewer women in astronomy to start with. They get offered a lot of invited talks, and if you've got a family and you're in Europe, it's easier to travel within Europe. So attending conferences here in Australia is a large challenge to female participation. (Kylie Williams, CAASTRO Event Manager)

A Code of Conduct for CAASTRO conferences and meetings was also established and read out at the beginning of each event to create clear expectations for acceptable behaviour.

The GAC established a set of **Gender Key Performance Indicators** and commenced collecting data and reporting on progress against these measures[5]. The GAC also surveyed members about both proposed and implemented gender interventions and adjusted their activities based on that data. Upon surveying the membership they found, for example, no clear preference for scheduling conferences outside school holidays, despite an earlier assumption that this was preferred.

[4] See Exhibit 3 – Gender Action Committee Terms of Reference
[5] See Exhibit 4 – Gender KPIs

With each of these actions CAASTRO challenged the pervasive lack of engagement with, and motivation to address, gender equality issues.

Although CAASTRO's success in addressing gender inequality in astronomy has been considerable, it has not all been smooth sailing. One challenge was always going to be the multi-nodal nature of the Centre. With nodes in seven tertiary institutions in five states and territories, CAASTRO straddles numerous suites of university policies and legal systems. This has meant, for example, that some researchers are unable to access travel support for family members, or that attempts to draft job advertisements for women must respond to different discrimination laws across different jurisdictions.

Dealing primarily with postgraduate and postdoctoral researchers, CAASTRO is also limited in its capacity to address issues that affect women at the undergraduate level and contribute to them dropping out of the 'pipeline' rather than pursuing astronomical careers. Similarly, one Centre with a fixed life-span cannot singlehandedly address the issues that drive the competitive, publish-or-perish nature of academia that disadvantages women in a number of ways. Nevertheless, there are encouraging signs of a system-wide readiness to tackle these issues.

Figure. Challenge-Action Matrix

Challenge	**Action**
Pipeline: issues that cause women to drop out of the pipeline early, or before reaching senior levels • Stereotypes	Science outreach to girls Mentoring Conference & workshop gender targets
Caring: how the academic career structure disadvantages those with carer responsibilities by reducing their visibility and competitiveness • Career interruption • Travel • Productivity	Part-time options / flexible work hours Core meeting times Conferences alternating inside and outside of school holiday times Travel support Childcare at meetings/conferences Advocacy for the equal distribution of caring responsibilities within families
Engagement: the lack of engagement with, and motivation to address, gender equality issues	Flexible work hours Conferences alternating inside and outside of school holiday times Formation of the Gender Action Committee Conference & workshop gender targets Conference code of conduct

Conclusion

In 2010, the proposal to the Australian Research Council to establish a Centre of Excellence in all-sky astrophysics reflected Australian astronomy's under-representation of women at senior levels, with women nominated in only six of its nearly 40 senior research roles. In the field of astronomy, as a whole, women made up less than 20% of the paid workforce, and this showed no signs of improving without intervention. Gender stereotypes, a disproportionate share of caring responsibilities, and a lack of understanding of the subtle and complex nature of the challenges faced by women were systematically preventing them from entering the field or progressing through the ranks.

In approving the establishment of CAASTRO, the ARC challenged the executive team to attempt to change this story within their newly formed organisation. Under Bryan Gaensler's leadership a number of actions were put in place, including flexible workplace practices, outreach, mentoring, travel support, childcare at conferences, and the establishment of a dedicated Gender Action Committee. This progress on gender continued when Professor Elaine Sadler took over as Director in 2014, with the implementation of Gender KPIs, conference and workshop targets, and a conference code of conduct.

By this time, CAASTRO was making good on its undertakings to the ARC, with women forming over half the Executive and well-represented among PhD and postdoctoral researchers. At the crucial mid-term review, the ARC commended CAASTRO not only on its gender equity program, but on the "outstanding and supportive environment for their students and postdoctoral researchers" and "exceptional level of collaboration across the seven participating organisations".

> "The gender equity program is a highly noteworthy development within the Centre, fostering a high degree of awareness of gender equity issues throughout the Centre staff. The Centre … promotes a culture of increased staff awareness by hosting workshops and encouraging staff to attend women in leadership conferences, targeted appointments and mentoring, and a strong focus on family friendly employment arrangements. The percentage of women in the Centre, from students to employees, and the gender balance on committees and conference speakers were commended by the panel" (Australian Research Council, 2014).

What had begun as a box to tick to secure funding had become something far more significant, with an impact reaching far beyond one Centre of Excellence.

Brian Schmidt credits CAASTRO and Bryan Gaensler with motivating him to initiate SAGE (Science in Australia Gender Equity), a national accreditation and improvement program based on the UK Athena Swan Charter focusing on diversity and inequality in higher education and research organisations. The SAGE pilot was launched in 2015, with forty institutions around Australia taking

part. Many astronomy conferences in Australia now have free childcare, and the ARC itself now offers all Fellowships and Awards on a full or part-time basis (Australian Research Council).

Perhaps most significant has been the impact, on individuals and institutions, of CAASTRO's 'mainstreaming' of conversations about gender.

> One of the main legacies of the Centre is that you've produced this group of younger researchers who've at some level had their consciousness raised in these matters, who are then going to go and spread that all over the world. And the hope is that they will bring that culture with them wherever they go. (Professor Elaine Sadler)

> I was on a PhD selection panel at my university, and because I had had experience through different events and discussions with CAASTRO people around gender I had the confidence to point out that "we haven't shortlisted any women. There's 20 applicants and half of them are women and you're telling me that not one of them is good enough to be shortlisted?" The selection committee went back and we had more of a discussion as to who was chosen and who wasn't and a more in-depth look at what was going on. (Female postdoctoral researcher)

At an institutional level, the 2016 – 2025 decadal plan for astronomy identified four priorities for the Australian astronomy community, one of which was the "adoption of principles and practices that aim for at least 33% female representation at all levels of Australian astronomy by 2025" (National Committee for Astronomy, 2015). And, of course, it would now be unthinkable for anyone in astronomy to write a credible centre of excellence proposal without addressing diversity and equity.

> I think we've really changed the expectation of how big research is done in Australia. That equity is not something you do to make yourself feel good but that it's part and parcel of being excellent. That a Centre of Excellence cannot be excellent unless it's also inclusive (Professor Bryan Gaensler).

There is still much to be done. It is our hope that what has been achieved at CAASTRO will inspire those working in astronomy and other sciences to continue removing barriers to female participation until gender equality in science is the rule, not the exception.

Key learnings

What worked for CAASTRO

Leadership by example

- Advocacy from both senior men and women is critical.
- Advocacy from senior men promotes engagement and role models preferred practices.

- Advocacy from senior women provides role models for success.
- The need to recognise that the system needs changing, not women.

Making a conscious, sustained effort

- When people are not consciously aware of their decision-making processes the status quo is often reinforced, for example, in the preparation of the CAASTRO proposal.
- Even where progress is made, it can be reversed if awareness and effort is not maintained.
- Consciously articulating an organisation's commitment to equality communicates its significance and raises the awareness of others within and outside the group.
- Although egregious displays of sexism are rarely acceptable in modern workplaces, everyone – men and women, alike - have subtle, unconscious biases that influence how we treat others based on their gender.

Taking an evidence-based approach

- Providing objective evidence of a problem helps those who are not affected by it understand and become motivated to address it, especially in the scientific community.
- Collecting baseline data enables an organisation to target its interventions where they are most likely to have an impact.
- Measuring the impact of interventions contributes to progress and provides the opportunity to revisit interventions that are not working as they were intended.

Challenges for CAASTRO

Centralisation of responsibility

- Having the Executive team responsible for gender action among their other duties can lead to them being over-stretched and gender goals being deprioritised by default of lack of time and energy
- Centralising responsibility for action on gender within the existing leadership team risks excluding useful input from other members of the organisation and limiting their engagement with the strategies.
- CAASTRO successfully addressed this by creating a dedicated Gender Action Committee.

Making contingency plans for factors outside the organisation's control

- Large-scale change, particularly cultural change, is usually impacted by factors outside the organisation.
- Ensure strategies and targets are feasible in the context of these external factors and distinguish between short- and long-term goals.
- Advocate to change external factors, such as unequal distribution of caring responsibilities. disproportionate carer responsibilities by women.

Exhibits

Exhibit 1 – Key Players

Professor Bryan Gaensler

Director (2011 – 2014)

Professor Gaensler completed his postgraduate qualifications at The University of Sydney and at CSIRO's Australia Telescope National Facility. He subsequently held postdoctoral fellowships at the Massachusetts Institute of Technology and at the Smithsonian Astrophysical Observatory, was an associate professor of astronomy at Harvard University, and then was an ARC Federation Fellow and Australian Laureate Fellow at The University of Sydney. From 2011 to 2014, Professor Gaensler was the founding director of the ARC Centre of Excellence for All-sky Astrophysics (CAASTRO). Professor Gaensler currently has roles as the Director of the Dunlap Institute for Astronomy and Astrophysics, Canada Research Chair and Professor of Astronomy in the Department of Astronomy and Astrophysics at The University of Toronto, and the Canadian Science Director for the Square Kilometre Array (SKA).

Professor Elaine Sadler

Chief Investigator (2011 – 2014)

Director (2014 – present)

Professor Sadler received her PhD in in astronomy from the Australian National University. Following graduation, she worked at the European Southern Observatory and Kitt Peak National Observatory before moving to the Australian Astronomical Observatory. Professor Sadler was the recipient of three ARC Fellowships while working at the University of Sydney. She was President of Division VIII (Galaxies and the Universe) of the International Astronomical Union (2009-12) and Chair of the National Committee for Astronomy 2010-12). She was elected as a Fellow of the Australian Academy of Science in 2010. In addition to her role as Director of CAASTRO, Professor Sadler is a Professor of Astrophysics in the School of Physics at the University of Sydney.

Ms. Kate Gunn

Chief Operating Officer (2011 – present)

Kate Gunn has 25 years of business and entrepreneurial experience. Having been a Board Director for many years, including a past President of the National Foundation for Australian Women and a past Chair of the Government-funded National Women's Alliance *Economic Security4Women*, Kate was named one of the Australian Financial Review/Westpac's *100 Women of Influence* in 2012. She

has also been recognised with business awards from the National Enterprise Development Institute, Australian Capital Territory Minister for Business, and the Australian Capital Territory Chamber of Commerce and Industry. More recently, Kate was granted a scholarship to attend *a Women's Leadership Forum* at Harvard Business School.

Professor Brian Schmidt

Executive (2011 – 2013)

Theme Leader (2011 – 2013)

Chairperson, Gender Action Committee (2014 – present)

Professor Schmidt received completed his Astronomy Master's degree (1992) and PhD (1993) at Harvard University. He held postdoctoral fellowships at the Harvard-Smithsonian Center for Astrophysics, the Mount Stromlo and Siding Spring Observatories, and the Research School of Astronomy and Astrophysics at the Australian National University (ANU). Before becoming Vice-Chancellor of ANU, Professor Schmidt was a Distinguished Professor, Australian Research Council Laureate Fellow and astrophysicist at the University's Mount Stromlo Observatory and Research School of Astronomy and Astrophysics and he is known for his research in using supernovae as cosmological probes. He was elected a Fellow of the Royal Society (FRS) in 2012 and shared both the 2006 Shaw Prize in Astronomy and the 2011 Nobel Prize in Physics with Saul Perlmutter and Adam Riess for providing evidence that the expansion of the universe is accelerating. Professor Schmidt is a Fellow of the Australian Academy of Science, The United States Academy of Science, and the Royal Society, and was made a Companion of the Order of Australia in 2013.

Professor Rachel Webster

Chief Investigator (2011 – present)

CAASTRO Node Leader (2017- present)

Professor Webster gained her doctorate at Cambridge University before undertaking postdoctoral positions at the University of Toronto and University of Melbourne. While at the University of Melbourne she became the second female professor of physics in Australia, and currently leads the Astrophysics research group comprising more than 60 research students and staff. Professor Webster has been the chair of the National Committee of Astronomy and co-created a Women in Physics Program, which has helped increase the number of women graduating in physics at the University of Melbourne. She is also a Member of the Royal Society of Victoria (2008), Fellow of the Australian Institute of Physics (2007), Fellow of the International Astronomical Union, and Member of the American Astronomical Society (1988).

Exhibit 2 - Family Friendly Fact Sheet

CAASTRO
ALL-SKY ASTROPHYSICS

FACTSHEET: Family friendly workplace

CAASTRO is committed to a family friendly and flexible working environment.

Family friendly work hours

- Flexible working hours are encouraged particularly if it assists families' and carer's participation in the workforce.
- CAASTRO discourages routinely working outside of working hours, so as not to create the expectation that staff should always be available for work. The centre recognises that there are times when working from home is preferable or necessary and this can be negotiated with a member's direct supervisor.
- All positions with CAASTRO are offered with a part-time option.

Family friendly meeting times

- CAASTRO can provide flexible travel allowances so that researchers and students with children can attend meetings, conferences and workshops.
- All core CAASTRO meetings take place between the hours of 10am and 2pm where possible.
- Children are permitted to attend meetings where practical.
- Video-conference options will be provided for all CAASTRO run meetings and conferences, where this is practical.
- CAASTRO provides child care options for the Annual Science Conference each year, where practical.
- CAASTRO organised social 'brainstorming' activity is inclusive and held at a time suitable for all group members.

Family friendly workplace environment

- CAASTRO can assist with relocation questions regarding schools and childcare if required.
- Children are welcome in the workplace, especially during the School Holidays.
- Australia has a generous visa system which, in most cases, allows partners to work. Specialist visa advice is available from the member University partners.

Photo: Dr Ivo Seitenzahl and Dr Ashley Ruiter are CAASTRO members and Post Doctoral researchers at ANU.

As CAASTRO is a collaboration of a number of Australian Universities, please be aware that University Policy will always override CAASTRO policy where there is a difference.

Questions from potential applicants should be directed to the Chief Operating Officer at coo@caastro.org.

Exhibit 3 - Gender Action Committee Terms of Reference

CAASTRO

ARC Centre of Excellence for All-sky Astrophysics

Gender Action Committee

Terms of Reference

CAASTRO
June 2014

Exhibit 4 - Gender Key Performance Indicators

- % of female Chief Investigators
- % of female Partner Investigators
- % of female Associate Investigators
- % of female Affiliate members
- % of female Postdoctoral researchers
- % of PhD Students
- % of Students
- % of female Scientific Organising Committee Members at Conferences/Workshops
- % of female Local Organising Committee Members at Conferences/Workshops
- % of female Invited Speakers at Conferences/Workshops
- % of female Contributed Speakers at Conferences/Workshops
- % of female Visitors to CAASTRO
- % of female applicants for CAASTRO jobs
- % of female short-listed for CAASTRO jobs
- % of females offered CAASTRO jobs
- % of females accepted CAASTRO jobs
- % of female travel support
- % of female PhD support

References

Australian Academy of Science. Gender equity. Retrieved 4 November, 2016, from https://www.science.org.au/supporting-science/gender-equity

Australian Bureau of Statistics. (2015). *4125.0 - Gender Indicators*. Retrieved 8 November, 2016, from http://www.abs.gov.au.

Australian Research Council. ARCHway - Ensuring a research career meets the needs of working parents. Retrieved 4 November, 2016, from http://www.arc.gov.au/news-media/news/ensuring-research-career-meets-needs-working-parents

Australian Research Council. (2014). CAASTRO Mid-term Review.

Australian Research Council. (2016). *Fact Sheet - Centres of Excellence*. Retrieved 28 October, 2016, from http://www.arc.gov.au/fact-sheet-centres-excellence.

CAASTRO. (2011). *Annual Report*. Retrieved 28 October, 2016, from www.caastro.org.

CAASTRO Web Page. Vision and Mission. Retrieved 28 October, 2016, from http://www.caastro.org/about/vision

Ceci, S. J., Williams, W. M., Ginther, D. K., & Kahn, S. (2014). Women in Academic Science: A Changing Landscape. *Psychological Science in the Public Interest, 15*(3), 75-141. doi: 10.1177/1529100614541236

National Committee for Astronomy. (2005). New Horizons: A decadal plan for Australian astronomy 2006-2015: Australian Academy of Science.

National Committee for Astronomy. (2015). Australia in the era of global astronomy: the decadal plan for Australian astronomy 2016-2025: Australian Academy of Science.

Science in Australia Gender Equity. Retrieved 28 October, 2016, from http://www.sciencegenderequity.org.au/