



CUWiP UK 2020 Evaluation Report

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Introduction

March 2020 saw the sixth Conference for Undergraduate Women in Physics (CUWiP) in the UK taking place at the University of York. Building on the highly successful previous conferences, the organising committee prepared a stimulating and packed programme of talks, seminars and visits, designed to support and encourage young women in their physics careers. 84 women from universities and institutions across the United Kingdom and Ireland participated in CUWiP 2020 and, as in previous years, their positive feedback showed that they had found the experience to be amazing and inspiring – simply to be in a room full of so many women physicists was a novel and stimulating experience for nearly all concerned.. This report presents an overview of the evaluation of this conference, drawing on feedback from participants.

The necessity of such initiatives as CUWiP cannot be underestimated: the proportion of female full-time first year students studying physics undergraduate degrees in the UK is only 21% (Institute of Physics, 2012), and there has been no significant increase in this figure for years (<https://www.hesa.ac.uk/data-and-analysis/students/what-study>). At A-level (the qualification taken by many pupils in the UK at age 18, and usually viewed as the qualifications needed to enter university), Physics entries have been rising in recent years, and the increase in female pupils in 2019 (compared to 2018) was 4.9% (compared to an increase of 6.5% from 2017 to 2018). The number of male entries only increased by 2.5% (2018-2019) and 2.4% (2017-2018). However, the female to male ratio in physics at 23:77 is in sharp contrast to the headline: ‘female science entries overtake males for first time’ (Joint Council for Qualifications, 2019, press notice p.1). Across the three sciences of biology, chemistry and physics, 50.3% of entries were female (49.6% in 2018), but this figure clearly hides huge discrepancies between the three subjects. CUWiP UK aims to inspire these women who have chosen to study physics at university, to help them develop as scientists and to showcase options for their educational and professional futures.



Figure 1 Group photograph outside the Exhibition Centre.

I really enjoyed the conference. It was so nice to meet so many other female physicists from such different backgrounds. Has definitely given me lots more confidence and made me realise not only the many opportunities available, but made me feel like they are something I can accomplish.

(Feedback from one participant)

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Executive Summary

The Conference for Undergraduate Women in Physics (CUWiP) UK 2020 aimed to support and broaden the participation of women in physics by providing information, resources, networks and motivation to pursue advanced degrees and/or careers in physics. This, the sixth UK event, was hosted by the Department of Physics at the University of York. The organizing committee, led by Dr Petri, advertised CUWiP UK 2020 across the UK and Ireland with the help of the IoP Women in Physics Committee, letters to the chairs/heads of all physics department in the UK and social media. The initial uptake was slower than in previous years, and the IoP CUWiP committee would be advised to work closely with future organising committees to ensure the event has as high a profile as possible. As in previous year, the applications came from a wide number of institutions across the UK and Ireland. The website seemed to operate smoothly for application (although not all forms were completed) and registration, and all those who registered also completed the pre-conference questionnaire.

The participants came from a variety of backgrounds, with academic attainment and ethnicity reflecting the female undergraduate population as a whole. About one-quarter of participants' parents had no qualifications above GCSEs, and another quarter had left education after A-levels, suggesting around 50% of participants had parents who did not attend university. Around 62% of participants claimed that physics played little or no part in their family life. The findings suggest that the conference was supporting widening participation in higher education, and the application review process continues to be robust and transparent.

The participants gave extremely positive feedback about their experiences at the conference and the opportunities available to them. The conference was clearly effective in meeting its aims, with three quarters of the respondents being able to identify specific actions they would now take as a result of attending CUWiP UK 2020. These ranged from getting involved in outreach programmes at their own institutions, to applying for PhD positions, to contacting speakers at the conference for individual advice. Many said they now felt much more confident about pursuing a career in physics (this increased from 38% before the conference to 73% afterwards), and there were many comments testifying how much they had enjoyed and benefitted from the conference. It was clearly a transformative experience for many, and it is evident from the feedback that this conference series should continue.

Given the resounding success of this sixth conference, the IoP CUWiP committee has secured funding for subsequent conferences and held an application round for the next two venues. An early Spring date seems to be favourable, although this may be affected by the pandemic situation as this unfolds over the coming months. The range of speakers and experiences provided seem to be highly valued by the participants, especially the opportunity to visit facilities, and to hear from a wide range of speakers from a variety of backgrounds. The organising committee is to be commended on including all students who identify as women, but may wish to consider the extent to which other diversity issues are addressed by the conference. The advertising and application processes should continue to be monitored to ensure the conference is widely publicised and the application process is easy to follow.



Figure 2 Participants in deep discussion.

Aims of the conference

The lack of women studying and working in physics continues to be an international problem, as discussed by Brewe and Sawtelle in their editorial to the *Physics Review Physics Education Research Focussed Collection on Gender* (2016), and one without an obvious solution. However, it is not a problem shared by every country, with Turkey being a notable example where female participation in physics increased to 53% in 2010 (Er, Ugur and Aktas, 2013). Research has suggested that increasing students' engagement with physics and their sense of belonging in the field of physics can be important when trying to increase female participation (Eddy and Brownell, 2016). It has been recognised that conferences play a key role in the development of the physics community (Dounas-Frazer, 2020) and events such as CUWiP provide opportunities to “*challenge the reproduction of middle-class white masculinity in physics*” (p.174).

The sixth CUWiP UK conference took place on 12th – 15^h March 2020 in the Department of Physics at the University of York, just a week before the UK entered lockdown due to the Covid-19 pandemic. The conference was affected by the pandemic, with two excursions being cancelled by the venues, a workshop being called off by the panel members, and 24 of the participants did not attend.

The aims of the conference were to help undergraduate physics students who identify as women continue in physics through participation in a conference focused on their development as scientists and showcasing options for their educational and professional futures through inspirational talks, career development workshops, panel discussions, and visits to state-of-the-art laboratories, and to encourage them to pursue their aspirations with confidence. It was hoped that participating in the conference would help to develop students' self-concept and self-efficacy beliefs, and hence encourage them to persist in physics-based careers after graduation. Both self-concept and self-efficacy are considered important factors in career choices (Kelly, 2016), and these will be discussed further.¹



Figure 3 Academic panel.

Self-concept: the extent to which participants view themselves as physicists

Identifying with a field can be seen as a key step to participation in a field, and a number of factors have been identified by researchers as to why women and girls tend not to see themselves as physicists. One is the tendency for physics to be associated with masculine, rather than feminine or gender-neutral attributes (Murphy & Whitelegg, 2006). Male stereotypes of physicists can deter women, as can negative stereotypes about the capacity of women to succeed in physics, and the lack of female role models (Cheryan et al., 2017;

¹ N.B. From this point, all references to ‘girls’, ‘women’ or ‘female students’ include all those who identify themselves with this gender.

Kelly, 2016). Through the contributions from the range of speakers, the conference organisers hoped to show positive role models of women who had succeeded in physics and to break down some of the stereotypes. Initial analysis shown in Table 1 shows that only 42% viewed themselves as physicists prior to the conference, but 76% did so afterwards; as one participant stated in the feedback questionnaire: “*I definitely feel much more motivated and confident to pursue a career in physics.*”

Table 1. Participants' self-concept beliefs before and after the conference.

Extent to which participants viewed themselves as physicists	Not at all ←————→ Very much so				
	Pre-conference	2.8%	18.3%	37.6%	26.6%
Post-conference	0%	6.3%	17.5%	45.0%	31.3%

Thank you so much for the opportunity. It was unbelievably uplifting and very much appreciated!

Feedback from one participant.

Self-efficacy: the extent to which participants believe they can succeed in physics

As well as supporting participants to feel part of the physics community, the conference organisers also wanted them to believe they could succeed in physics-related studies and careers, and to feel secure in this success – to improve their self-efficacy beliefs. Young women studying physics are more likely to think they need help and less likely to think they are good at physics (Mujtuba & Reiss, 2013). Whilst it is not clear if improving women’s self-views to be comparable to men’s self-views is altogether desirable (Cheryan et al., 2017), the importance of women being motivated to persevere in physics is well-recognised (e.g. Kelly, 2016), and self-efficacy is a good predictor of success in studying physics (Sawtelle et al., 2012). ‘Imposter syndrome’, defined as ‘*believing that one’s accomplishments came about not through genuine ability, but as a result of having been lucky, having worked harder than others, and having manipulated other people’s impressions*’ (Langford & Clance, p.495, 1993), is a concept with broad recognition (e.g. Francis et al., 2017), and it is known that women in physics fields are more likely to feel like imposters than their male counterparts (Ivie, White & Chu, 2016). As in previous years, the conference aimed to encourage participants’ self-efficacy beliefs through a range of experiences and opportunities, and Table 2 shows participants’ levels of confidence about their future study and career plans before and after attending CUWiP 2020. Participants’ responses to the post-conference questionnaire indicated that 53% now felt confident in applying for post-graduate courses, compared with 32% prior to the conference, and 73% felt confident that they would be successful in a physics career (an increase from 38% before the conference). The participants also felt part of a community of women in physics, identifying the speakers and organisers as mentors whom they would contact in future for advice and support, and seeing a role for themselves in supporting peers. Prior to the conference, only 35% of participants felt part of the physics community, with this increasing to 70% afterwards. One participant identified her follow-up



Figure 4 Professor Daniela Bortoletto and Dr Marina Petri.

action would be “becoming more proactive in applying for different opportunities and being more confident in my abilities and encouraging younger women in physics I know.” Another said that she now felt “more confident in my ability to balance various aspects of social/family life in my future career in academia?”. Another resolved to “It’s a bit cheesy but believing in myself and applying for things that I’m enthusiastic about even if I don’t necessarily meet 100% of the requirements.” In particular, it was clear that participants now had a better understanding of the multiple ways in which a career in physics could develop: as one participant stated, she was now determined to be “more proactive in finding opportunities in physics and taking them. I will explore less traditional options in terms of finding a job I am happy with.”

Table 2. Participants' confidence levels in further physics study and physics careers before and after CUWiP 2020.

Extent to which participants felt confident in applying for post-graduate courses	Not at all ←————→ Very much so				
	16.2%	22.9%	28.6%	21.0%	11.4%
Pre-conference	5%	13.8%	28.7%	26.3%	26.3%
Extent to which participants felt confident that they would succeed in a physics career	Not at all ←————→ Very much so				
	7.6%	25.7%	30.5%	23.8%	14.3%
Pre-conference	1.3%	1.3%	25.0%	41.3%	31.3%
Post-conference					

Thus it can be seen that CUWiP 2020 did achieve its aim to improve the participants’ self-concept and self-efficacy in physics.



Figure 5 Group discussion.



Figure 6 Enjoying conversations at coffee time.

Conference Programme

In order to achieve these goals, the three-day event included (the full programme of the conference is included in Appendix One):

1. **Talks by distinguished speakers:** Dame Jocelyn Bell Burnell; Professor Petra Rudolf, University of Groningen; Professor Marialuisa Aliotta, University of Edinburgh; Professor Daniela Bortoletto, University of Oxford; Dr Marina Petri, University of York and Royal Society University Research Fellow, and Sue Nelson, science journalist.
2. **Industry panel** providing information about career options: Heather Barton, EDF; Dr Sarah Dempsey, Peratech Holdco Limited ; Samantha Wilkinson, National Nuclear Laboratory; Leah Morgan, UK Atomic Energy Authority, and Xanthe Jackon, BAE Systems.
3. **Academic panel** providing information about application to postgraduate studies and subsequent career options: Professor Marialuisa Aliotta, University of Edinburgh; Professor Petra Rudolf, University of Groningen; Professor Sarah Thompson, University of York, and Dr Kate Lancaster, University of York.
4. **Engaging with the Media workshop**, led by Sue Nelson.
5. **Meet a medical physicist workshop** with Annie Tonks, trainee clinical scientist in Medical Physics at Hull University Teaching Hospitals; Anna Clark, final year trainee clinical scientist at Leeds Teaching Hospitals; Jennifer Cannon, Clinical Scientist at James Cook University Hospital, and Heather Fulton, radiotherapy trainee at Leeds Teaching Hospitals.
6. **The Accumulation of (Dis)Advantage (or Nibbled to Death by Ducks)** with Dr June McCombie, University of Nottingham, on discrimination and unconscious bias.
7. **National laboratory tours** of the University of Sheffield Advanced Manufacturing Research Centre and the York Plasma Institute, University of York.
8. **Social Activities** to enhance networking opportunities.



Figure 7 Meeting Dame Jocelyn Bell Burnell.

Location of the events

The conference main hub was the Exhibition Centre on the University of York's Campus West, and was where all the lectures and workshops took places, along with a number of meals and social events. The evening dinner on the Saturday night was held at the National Railway Museum, and accommodation was provided at Staycity Aparthotels, Paragon Street, York.

The whole conference was very inspirational, thoroughly enjoyed!!
Feedback from one participant.

Application Process

CUWiP UK 2020 was advertised across the UK from 7th December 2019, with flyers and targeted emails sent by the IoP including individual e-mails to the heads of all physics department in the UK advertising the conference. In addition, the Women in Physics societies were contacted and also the participants from previous years were contacted and asked to encourage other students in their institution to apply. Social media was also used to direct female undergraduate students to the CUWiP UK 2020 website. Here potential applicants could find information about the conference, its aims and objectives and how to apply. The conference website and application process had been highly successful for the previous conferences and so a similar format and design was used. Some discussion was had by the IoP CUWiP committee about the merits of screening demographic data as part of the widening participation agenda, and collecting data on incidences of sexual harassment. In both cases, it was decided that no additional attempts would be made to collect this highly sensitive and confidential information as making ethical, effective use of it would be highly problematic. Applications were made online via the conference website and applicants were asked for the information listed in Table 3.

Name and contact details
Field of study
Current course and university attended
Expected graduation date
Need for travel cover
Conference availability
Whether or not they applied for the 2019 conference
Personal statement, with guidance suggesting applicants describe briefly their background, goals and why they would like to attend the conference

Table 3. Information given by applicants

Initially, only 61 applications were received by the closing date of 10th January 2020, and these were reviewed by 3 members of the organising committee to check they were up to standard, but with further publicity and an extended deadline to 2nd February, this was increased to 155 from students at 40 institutions. These were allocated to the same 3 reviewers who used the following selection criteria:

- ✓ Priority was given to students meeting one or more of the widening participation criteria
- ✓ Priority was given to students who were able to attend all 4 days of the conference
- ✓ Priority was given to students who had not attended the conference previously
- ✓ Priority was given to 3rd and 4th year undergraduate students, although all were encouraged to apply.

Following this review process, 120 applicants were informed their application had been successful and they should now proceed to register for CUWiP UK 2020 on the conference website. Part of the registration process included the completion of the pre-conference questionnaire (though this was not compulsory) and there were 108 individual responses to the questionnaire. The findings from the questionnaires will be discussed in more detail elsewhere, but suffice

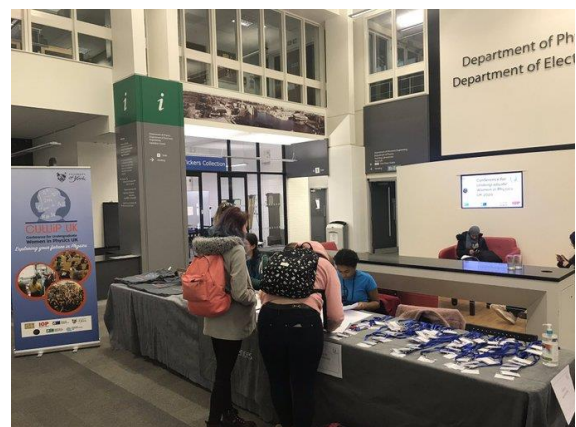


Figure 8 Registration desk.

to say at this stage that the response rate was good, with typically fewer than 10 respondents skipping any one question.

Figure 9 shows the number of applications and participants from each university across the UK. This suggests that the geographic spread of applications was wide; indicating the marketing of the conference was successful in reaching a large number of institutions, as was the case for the previous conferences.

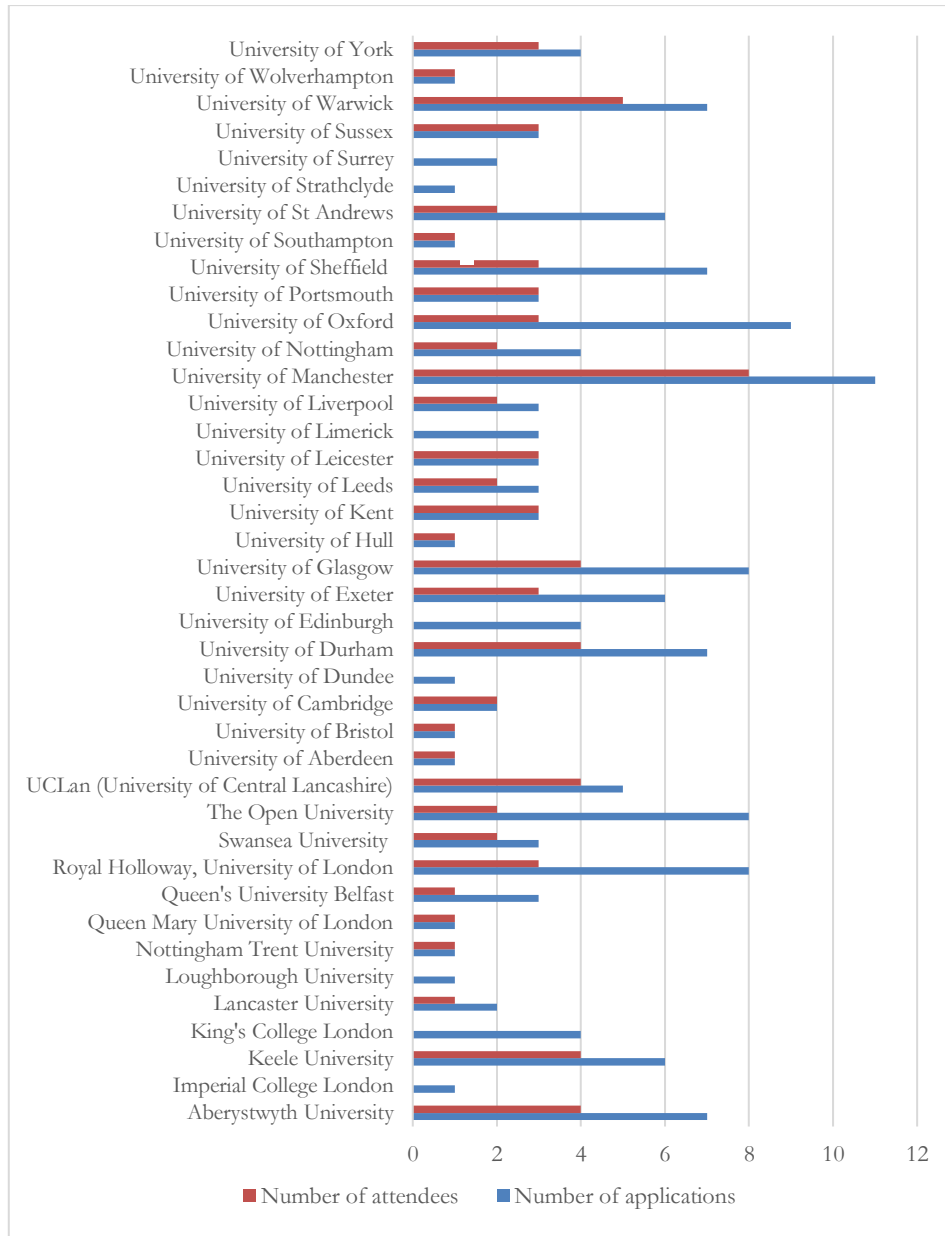


Figure 9. Applications and participants by institution

Institution	Participants unable to attend
The Open University	2
Keele University	1
King's College London	2
Lancaster University	1
Queen's University of Belfast	1
Royal Holloway University of London	2
University of Dundee	1
University of Durham	1
University of Edinburgh	2
University of Exeter	1
University of Leeds	1
University of Limerick	2
University of Liverpool	1
University of Nottingham	1
University of Oxford	2
University of Sheffield	1
University of St Andrews	2

Table 4 Number of participants who were not able to attend the conference

Unfortunately, 24 of these successful applicants were not able to attend the conference in the end, due to the Covid-19 situation. Table 4 shows the institutions these participants come from – there is clearly little pattern to these; rather they are a reflection of the circumstances of each individual at that point in time.



Figure 10 The Accumulation of (Dis)Advantage by Dr June McCombie.

This experience was very valuable and I would recommend attending this conference to all my women physicist friends. I now have a network of women physicists throughout the UK which I love. I also learned more about different paths for physics and different types of jobs available which was extremely interesting. It was also amazing to here from famous women physicists and their journey. Very informative and lovely. Overall a great experience and I genuinely had a lovely time. Would highly recommend to all my women physicists friends.

Feedback from one participant.

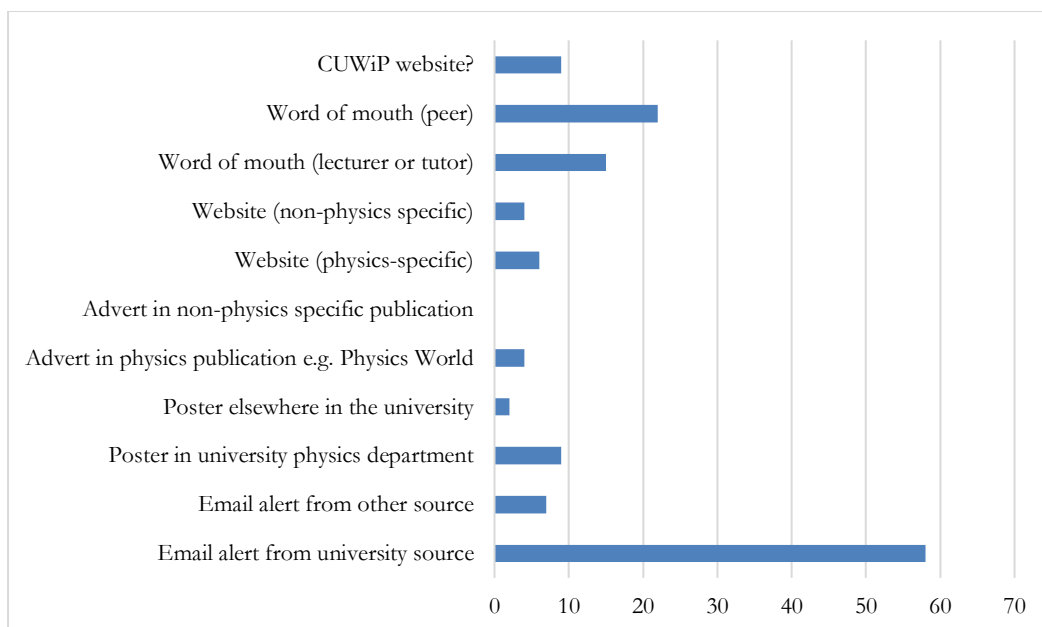


Figure 11. Mechanism by which participants heard about CUWiP UK 2020.

Participants were asked how they had heard about CUWiP UK 2020, with their responses shown in Figure 11. The overwhelming majority received an email about the conference from the university physics department, with the head of department and female academics often making students aware of the opportunity and encouraging them to apply, with some offering financial support. Peer word of mouth continues to be important particularly from previous participants: *‘Lots of people in my year attended last year and highly recommended it to me.’* However, there were several comments about only being alerted by the university after the application deadline had been extended, so this is possibly something for the IoP CUWiP committee to explore. Overall, given the final number of applications from across the UK and Ireland, it would appear that the marketing of the conference was successful and the application process easy to follow.



Figure 12 Dr Marina Petri, Professor Petra Rudolf, Dame Jocelyn Bell Burnell, Dr June McCombie and Professor Daniela Bortoletto, outside the Exhibition Centre.

Characteristics of Participants

Academic attainment

As part of the pre-conference questionnaire, participants were asked to report their current average grade in their physics degree. Their responses can be seen in Figure 13.

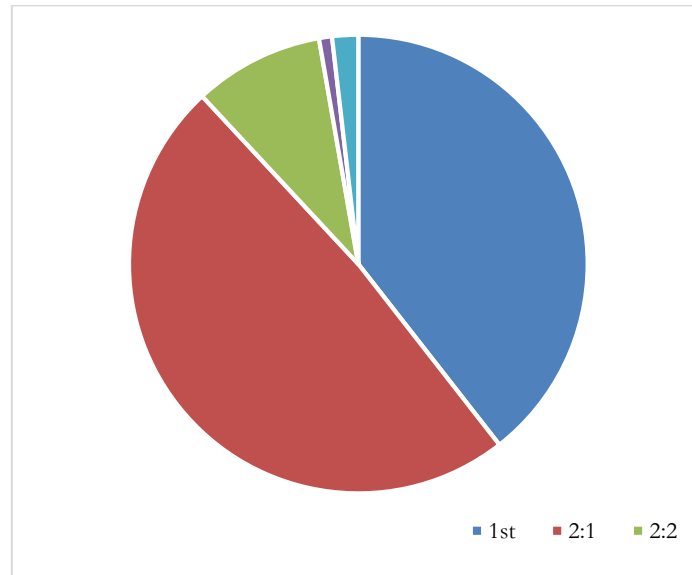


Figure 13. Participants' reports of their current average degree grade.

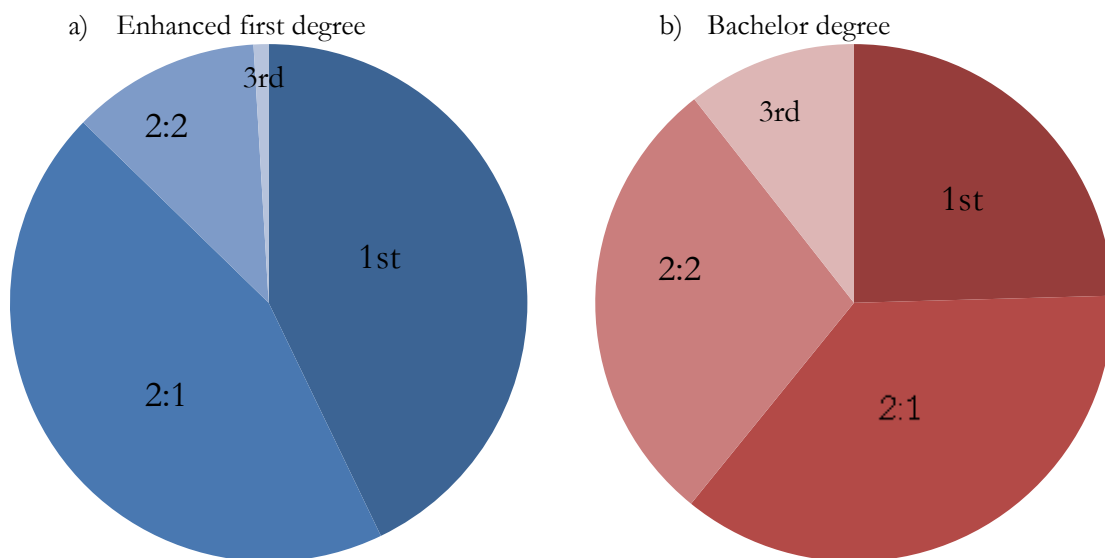


Figure 14. Degree classification of female students completing physics courses 2004/05 to 2009/10 (IoP, 2012).

Figure 14 shows the degree classifications achieved by female students across the UK from 2004/05 to 2009/10, with there being a clear difference between those who complete an enhanced degree e.g. MPhys, and those who complete a Bachelor's degree (the latter are typically undertaken by lower attaining students). In previous years, over half the participants have reported their current grade to be a 1st, with this proportion being lower for the CUWiP UK 2020 participants. Nevertheless, the grades reported in Figure 13 would appear to be in line with national figures.

Ethnic background

Participants were asked which ethnic group they identified with and the responses can be seen in Table 5.

With which ethnic group do you identify?	Response %
Prefer not to say	3.7%
English / Welsh / Scottish / Northern Irish / British	55%
Irish	2.8%
Gypsy or Irish Traveller	0.0%
Any other White background (please describe in box below)	16.5%
White and Black Caribbean	0.9%
White and Black African	0%
White and Asian	1.8%
Any other Mixed / Multiple ethnic background (please describe in box below)	1.8%
Indian	0.9%
Pakistani	2.8%
Bangladeshi	1.8%
Chinese	4.6%
Any other Asian background (please describe in box below)	3.7%
African	0.9%
Caribbean	0.0%
Any other Black / African / Caribbean background (please describe in box below)	0.0%
Arab	0.0%
Any other ethnic group (please describe in box below)	2.8%

Table 5. Ethnic background of participants.

Although this question can be sensitive, very few respondents skipped or preferred not to say (3.7%) and so this can be taken as representative of the participants as a whole. The majority are White British, with the next largest group being White European (listed as White Other in the table, but mostly explained as European in the comment box available). 22% identify as Black or Minority Ethnicity (BME). This can be compared with national level data compiled by the Institute of Physics (IoP) in Table 6.

	Male	Female	Physics	All courses	CUWiP UK 2017	CUWiP UK 2018	CUWiP UK 2019	CUWiP UK 2020
White	90.7%	84.8%	89.5%	78.7%	78.4%	80.4%	76.2%	74%
BME	9.3%	15.2%	10.5%	21.3%	17.7%	17.7%	23.2%	22%

Table 6. The ethnicity of full-time first-year UK domiciled students on first degree courses in physics in 2009/10, compared with CUWiP data. (IoP, 2012).

Consideration of Table 6 would suggest that the ethnic background of the participants at CUWiP UK 2020 is typical of the undergraduate population in the UK, and considerably more diverse than the typical physics undergraduate population.

Previously I have struggled to imagine my connections with female physicists in a role-model stance; I have only one female lecturer at university. This conference has reconnected me with my subject after a difficult year and begun my connection with the community, which I had previously not realised was a lacking aspect of my life. I feel empowered and excited. Thank you.

Feedback from one participant

Family background of participants

Participants were asked a number of questions about their family background in order to gain a better understanding of the potential influences on their aspirations and choices. The first question asked what was the highest level of education for their parents/guardians and step-parents/guardians? Responses can be seen in Figure 15.

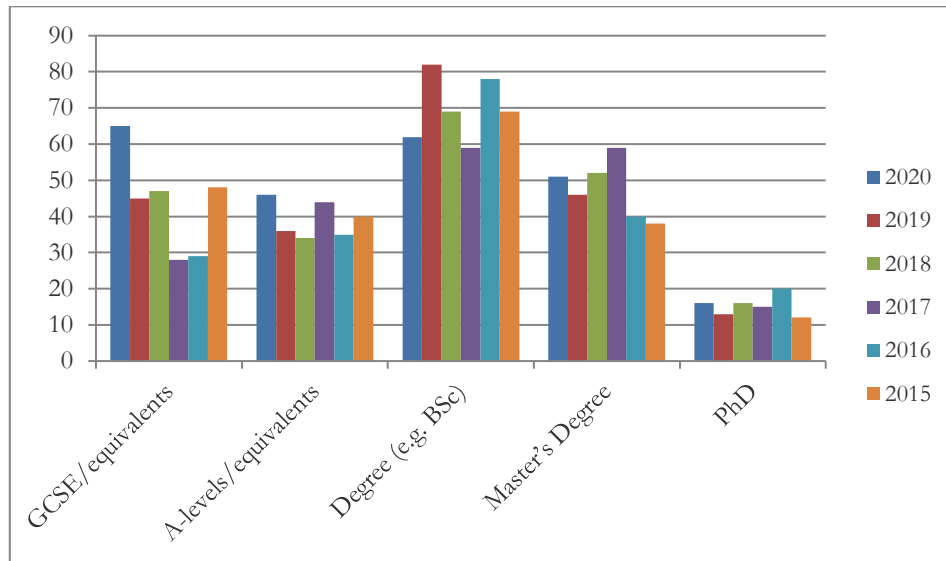


Figure 15. Highest level of education for participants' parents.

Figure 15 shows that the majority of participants have a parent or guardian who left education after GCSE, and a similar number have a parent or guardian who have gained a first degree. Around half the participants report that they have a parent or guardian whose highest level of education are A-levels, and the same number of Master's degrees. A small number of parents/guardians have a PhD. This would suggest that the conference attracted a significant number of participants who have one or more parents who did not attend university. As widening participation in higher education is commensurate with the aims of the conference, this is gratifying.

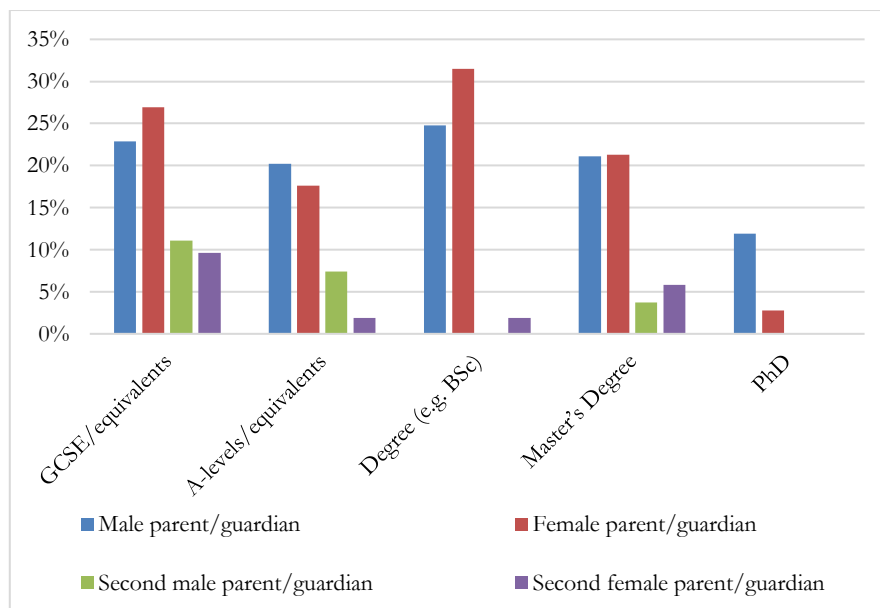


Figure 16. Highest level of education for participants' parents/guardians by gender.

Figure 16 shows the same data broken down by gender. Although the trends are the same, there are some interesting differences between the male and female parents/guardians, with more male parents having obtained a PhD, more female parents a degree, and more female parents GCSE equivalents – the numbers are fairly similar for the other categories. The numbers for step-parents are small and little pattern can be seen.

National data is available about the parental occupation of full-time UK-domiciled students on first degree courses from 2004/05-2009/2010 (IOP, 2012). Figure 17 shows that there is little difference in parental occupations between male and female students, with Figure 18 showing that proportionally, more physics students are likely to have parents in higher managerial and professional occupations than students on other degree courses.

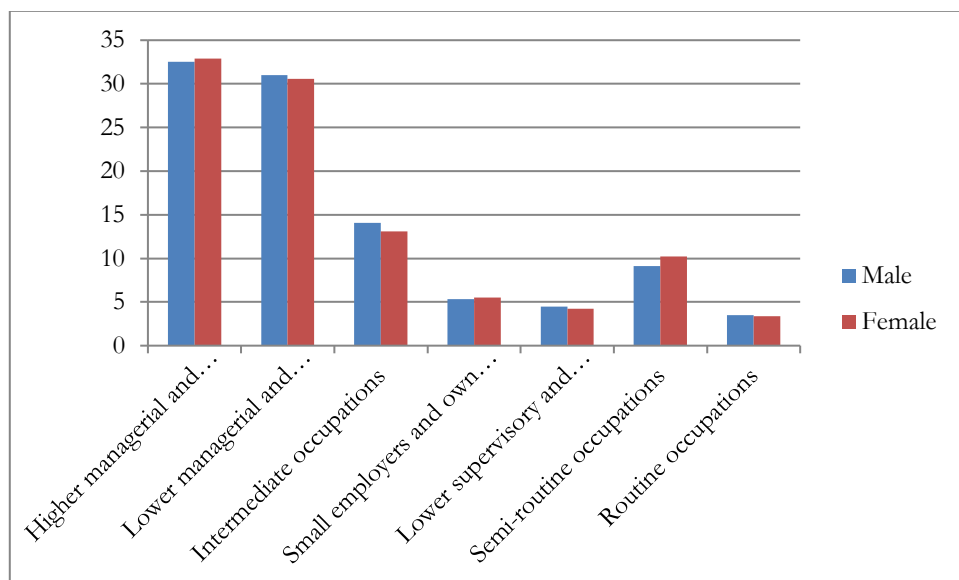


Figure 17. Parental occupation of male and female physics students (IoP, 2012).

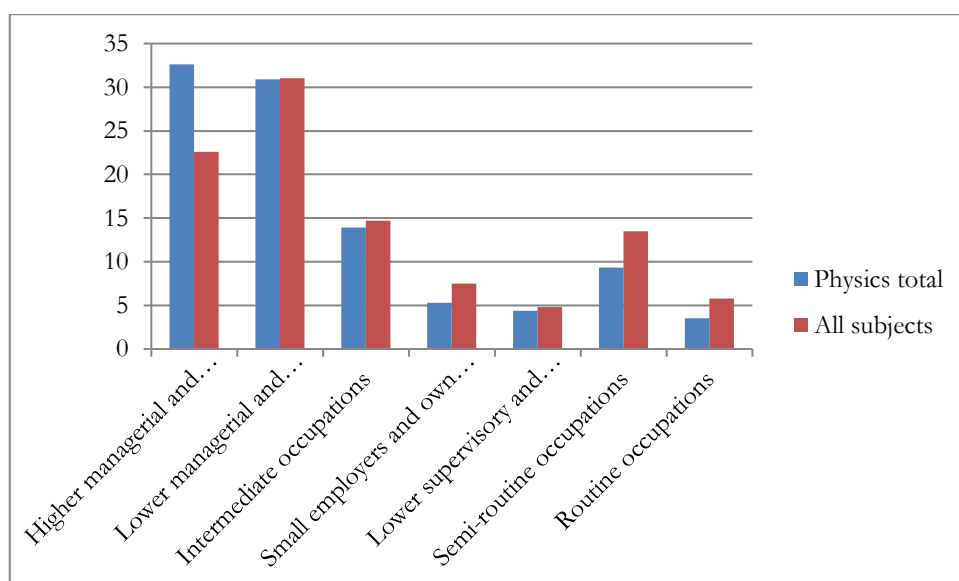


Figure 18. Parental occupation of physics students and students on all first degree courses (IoP, 2012).

Participants were also asked about their family's interest in and attitudes towards physics, with these responses seen in Figure 19.

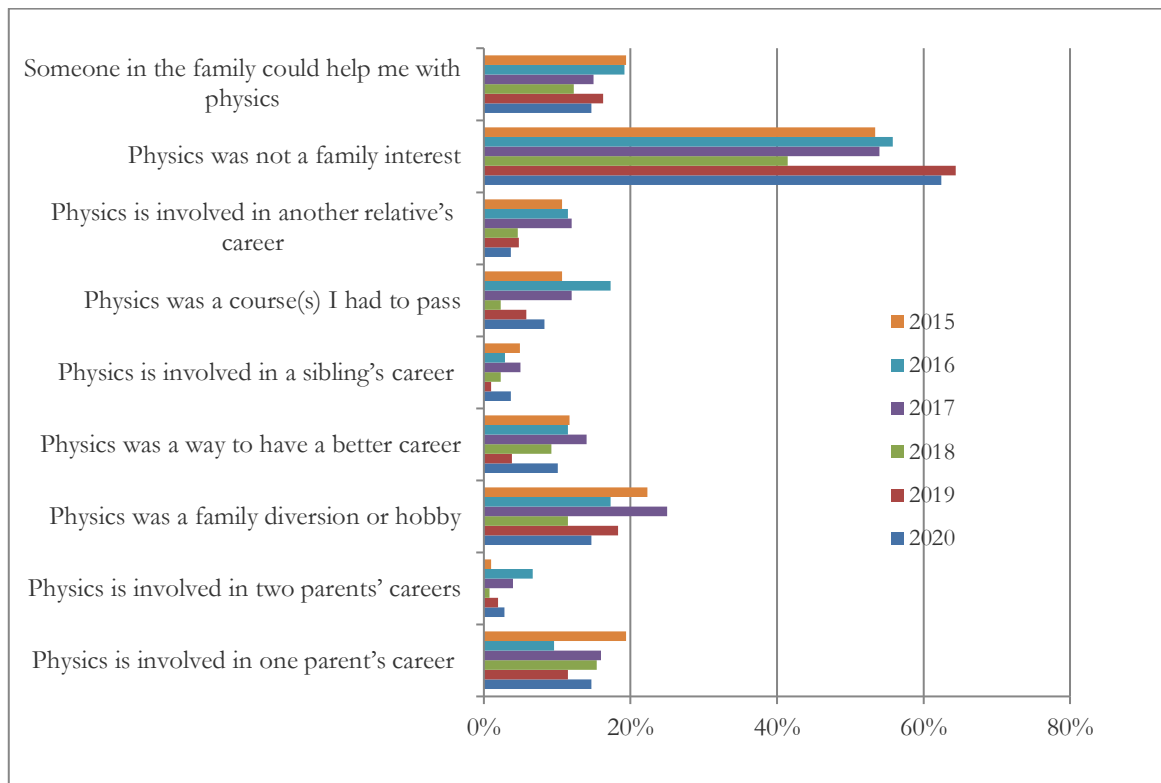


Figure 19. Interests in and attitudes towards physics in participants' families

As in previous years, physics was not an interest in the families for a significant number of the participants (62%). For the rest, physics played some role in family life, with this taking a variety of forms. 41 participants added a comment to this question, with 24 of these indicating that the person/people in question were male, 12 referred to both male and female relatives, and 2 referred only to female relatives, with these numbers being comparable to the data from previous conferences. There is a wide gender discrepancy here, which probably reflects the female rate of participation in physics in recent decades.

We are all really very grateful to the organising committee, speakers and the student ambassadors. The event was really well put together and the talks were really engaging. The passion of the speakers sort of renewed my interest that might have been beaten down a bit through drier lectures and learning for exams. Having the opportunity to meet all these female physics students from diverse backgrounds was really lovely and very interesting to find out about their different physics interests.

Feedback from one participant.

Experiences at the Conference

The post-conference questionnaire had 80 responses this year, which, at 95%, is an excellent rate of return and the organising committee is to be commended on ensuring the participants completed this before their departure on the Sunday afternoon. 77 responding on the last day of the conference (Sunday 15th March 2019), 1 on Monday 16th March and the final 2 within a week of the conference ending. Very few respondents skipped any of the multiple-choice questions, suggesting that the responses can be taken as representative of the respondents as a whole.

Participants were asked to rate a number of aspects of the conference, from the websites for application and registration, the meals and accommodation, and the various parts of the conference programme. Their responses can be seen in Figure 20.

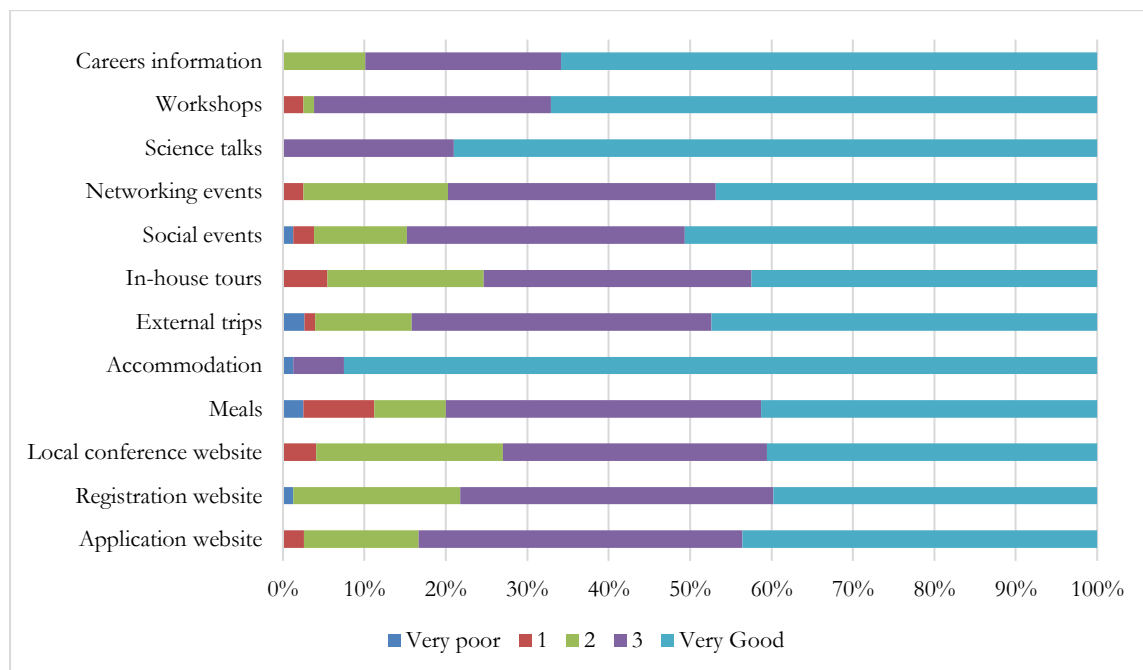


Figure 20. Participants' opinions about various aspects of the conference.

The responses are overwhelming 'very good' or 'good', which is gratifying for the conference organisers. Two people commented on the quality and quantity of vegan food, and there were a couple of other comments about the amount of food and the choices available, with one person requesting that food be ethically or sustainably sourced. Suggestions included making the panel sessions shorter, including someone linked to secondary teaching on the industry panel, having more organised social activities, having more in-depth science talks, and also addressing issues of ethnicity and sexuality – this may be something for the organising committee to consider for future conferences. One person seemed to have completely missed the point of the conference, complaining that “*The event had far too much focus on gender over the fact that we are physicist[s] and that gender should not make a difference there.*” (she is responsible for the majority of the 'very poor' scores). Whilst the conference organisers might well agree with the laudable belief that gender should not make a difference, the reality of the lives we have lived in physics over several decades is that gender does make a difference, and one which is negative for women. The conference organisers are to be commended for their efforts to support, encourage, and prepare these (mostly) young women to succeed in careers in physics. Several people did comment on the length of the days and how tiring it was – again, this is something for the organisers to consider.



Participants were asked if they were able to participate in a variety of activities during the conference, whether or not they did participate, and the extent to which they found this valuable. Their responses can be seen in Table 7.

Figure 21 Dinner at the Railway Museum.



Answer Options	Yes there was an opportunity	No there was no opportunity	Yes I took part	No I didn't take part	Yes the activity was valuable	No the activity was not valuable
Interact socially with older students	53	3	52	5	55	3
Receive advice/mentorship from older students	46	12	34	14	40	3
Interact socially with younger students	49	6	47	2	47	4
Provide advice/mentorship for younger students	52	13	32	10	36	4
Interact with a role model individually	56	6	34	18	47	0

Interact with a role model in a group setting	57	2	49	6	55	1
Network professionally with a role model	56	7	24	27	24	2
Find a mentor you will connect with after the conference	45	18	17	29	18	3
Tour a national laboratory or observatory	33	26	30	10	35	5
Tour one or more in-house laboratories	38	20	28	12	34	8
Workshop/session on careers in different sectors (industry, academia, etc.)	53	2	49	4	60	1
Hear about personal and professional trajectories of women physicists	53	0	48	1	67	0
Attend session about gender issues	47	3	44	6	57	2
Attend plenary/session about physics	47	10	36	4	52	3
Interact with others between conference activities	52	1	53	1	62	2
Learn about imposter syndrome	51	2	51	0	63	1
Learn about stereotype threat	35	20	33	9	40	7
Use social media (i.e. Facebook/Twitter/LinkedIn) to connect to other participants	52	6	44	10	43	2
Post to social media (i.e. Facebook/Twitter/LinkedIn) about conference activities	51	7	21	35	21	5
Attend session on research experiences	45	9	42	4	48	0
Attend session on post-graduate courses	31	34	22	14	25	4
Attend session on networking	32	34	18	14	25	4
Attend other sessions/events?	54	5	43	2	48	0
Ask questions or make comments during conference sessions	51	2	33	18	45	3

Table 7. Participants' views of the experiences offered across the conference programme (It should be noted that this question has been answered inconsistently, with more respondents indicating that an activity was valuable than had selected that it was available).

These findings are, like previous years, somewhat inconsistent as in a number of cases more respondents indicated that an activity was valuable than had selected that it was available. However, the findings clearly show that the majority of participants had the opportunity to participate in the wide range of experiences that the conference programme was intended to include, and the majority took up the opportunity and found it valuable. In particular, it should be noted that they valued the opportunities to meet with each other and the speakers, to hear about the personal and professional trajectories of women physicists, and to learn about imposter syndrome.

Overall, the feedback from the participants is that the conference was well organised, highly enjoyable, and structured in such a way that enabled the aims of the conference to be met, namely in that it

1. communicated the breadth of education and career paths open to physics graduates through the careers panel, academic panel and range of keynote speakers;
2. disseminated information and advice on applying for summer research studentships, post-graduate study and professional employment, again through the careers panel, academic panel and range of keynote speakers;
3. provided opportunities to share experiences, advice and ideas with women at different stages of their education or career paths, not only through the talks and panels, but also through the many opportunities participants had to network with the various speakers and the members of the organising committee.

The organising committee is to be commended on their hard work which had such positive results.

Absolutely amazing experience, definitely a highlight of my year.

Feedback from one participant.



Figure 22 Visit to the AMRC.

Effects of Conference Participation

Participants were asked to what extent they felt their participation in CUWiP UK 2020 had been important against a number of issues. These responses can be seen in Figure 23, and are extremely positive, suggesting that the conference was very successful in meeting its aims. (The four negative responses came from the participant who thought there was too much about gender....)

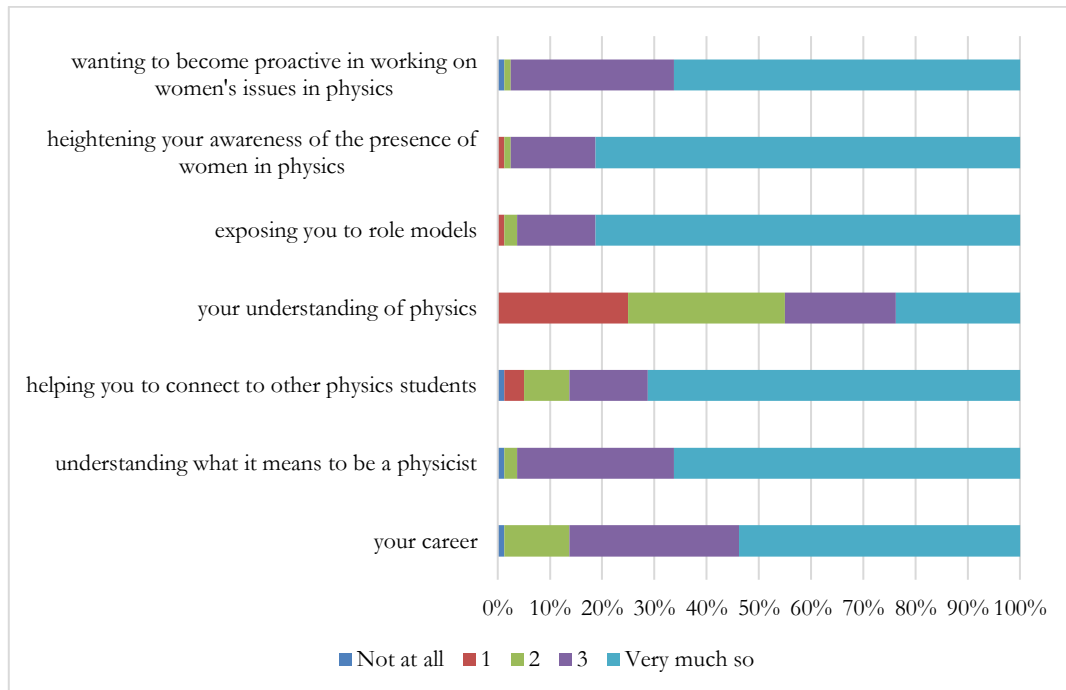


Figure 23. Participants' views of the importance of their participation in CUWiP UK 2020.

48 participants indicated they would like to be involved in organising CUWiP in the future, and 38 said they were happy to participate in further research evaluating the conference. They were also asked if there were any actions which they would now take as a result of attending CUWiP UK 2020, with 60 participants responding. Responses can be categorised as seen in Table 8, and it should be emphasised that this is an optional question, and is not designed to measure the participants' confidence levels – rather the question tests for specific actions. Three-quarters of the respondents were able to identify positive actions they would now take following the conference, clearly showing the positive impact of conference on the participants, as exemplified by one participant's words: *“Wasn't confident enough to pursue post-graduate education before but now I am excited to get home and apply to opportunities I found out about through this conference. I want to involve myself in research opportunities and outreach projects.”* Many could identify more than one positive action, both ones to develop their own careers and also actions to support and develop the community of physicists to which they now felt they belonged.

More pro-active about career	23
Network more – women in physics	15
Apply for post-graduate study	11
More involved in physics outreach	11
Be more confident in pursuing physics career	11
Network more – physics	7
Be more aware of unconscious bias	3
Work harder in their degree	2

Table 8. Participants' responses about what they intend to do after the conference

I have a better understanding of how to improve the prospects of the students within my subject. I also feel that I want to become an advocate for women in physics and organise events at my university to support them.

I feel much more motivated in my course and I feel that I have many more opportunities.

Feedback from participants.

The desired outcomes of the conference were to develop participants' self-concept and self-efficacy beliefs, and the responses seen in Table 8, together with the feedback quotations throughout the report, show that the conference did have the intended impact on participants. These will now be discussed in more detail.



Figure 24 The team of hard-working volunteers.

Self-concept beliefs

The development of participants' self-concept beliefs, or the extent to which they see themselves as physicists, through the conference has already been shown in Table 1, with a 34% increase in positive responses to the question 'To what extent do you see yourself as a physicist?'. As in previous years, the various responses to the post-conference questionnaire clearly show that participants now felt that physics was a field which they could be part of and one in which their career could develop. They felt connected to other women working in physics, identifying them as mentors who could be approached for advice and support. In addition, a number of participants could see a role for themselves as leaders and role models for their peers at university and younger female physics pupils in schools. Again, this outcome was successfully achieved.

Self-efficacy beliefs

Self-efficacy beliefs are complex in their construction and development, and the data under discussion here is not intended as a sophisticated measure of their self-efficacy beliefs. Nevertheless, three-quarters of the respondents chose to volunteer information about actions they will now take after attending the conference,

and to offer additional comments and these responses showed a high level of confidence in their ability to success in physics-related careers. The participants were inspired by the conference and left feeling highly motivated to continue their undergraduate studies. Large numbers of those who responded clearly felt that they could now aim higher in their academic and career aspirations, they felt empowered to share with other women in physics and to build networks, and a number felt motivated to work harder. Many participants stated a desire to study physics at Masters or PhD level in their application statements, but the findings from the post-conference questionnaire revealed that, as in previous years, now they felt these aspirations were achievable and worthwhile pursuing. All of these require confidence and a belief in the achievability of success. Examples of these responses are given as quotes throughout this report and they are a powerful testament to the effect of conference participation. This is strong evidence that their self-efficacy beliefs had been developed by the conference, and that it was successful in achieving the desired outcomes.

The conference was amazing, thank you all so much!

I will send an email because I am far too emotional and grateful to fit my joy in this little box.

I will definitely look to actively promote women in science within my university and through my social media, and look further into internships and masters courses.

Feedback from participants.



Figure 25 Listening to Dame Jocelyn Bell Burnell.

Conference Finances

Funding and Expenses

Most of the funding of the 2020 event came from sponsorship by leading science and physics education organisations: the Engineering and Physics Sciences Research Council (EPSRC) and the Science and Technology Facilities Council (STFC), the Institute of Physics (IoP), the Ogden Trust and Royal Society, with local funding being provided by the Quantum Hub, Athena SWAN and the University of York Department of Physics. The total funds received are listed in Table 9.

Income source	Amount
Quantum Hub	£2,000
EPSRC and STFC	£10,000
Athena SWAN budget	£1,000
IoP	£5,000
Ogden Trust	£5,000
Royal Society	£7,000
Delegate Registration (£30x £103)	£3,090
Delegate T-shirt purchase (£9 x 58)	£522
Department of Physics	£7,188
Total	£40,800

Table 9. Conference Income.

Expense description	Amount
Student and speaker hotel accommodation	£18,200
University room hire and catering	£9,875
Conference venue hire and dinner (National Railway Museum)	£7,500
Speaker/panellist expenses	£1,960
Coach hire/excursions	£1,050
Other costs including marketing and t-shirts	£2,215
Total expenditure	£40,800

Table 10. Conference expenditure.

The funding allowed the participation of 120 undergraduate students at the conference to be supported, although the final numbers were lower due to the Covid-19 pandemic. Food and room accommodation were covered for all participants, panellists and speakers. The participants were requested to pay a £30 registration fee whose purpose was to help offset a small portion of the cost of holding the conference and to minimize the number of students who register but then do not attend the conference. Participants were also encouraged to contact the head of their physics department and request them to sponsor the cost of the travel to and from the conference.

Value for money

The conference cost around £340 per registered participant which would seem to be a reasonable sum for the accommodation costs and the opportunities afforded by participation. Gaining access to such a wealth of knowledge and expertise about physics and working in the field of physics is not easily quantifiable, but the participants and organisers certainly considered their time and effort to be well spent and those who provided financial backing should feel their money was well invested. The effects of this conference will be felt in many careers for years to come.

Feel more confident in my ability to be a woman in physics. Gained valuable knowledge on the skills and attributes that help and learn that success is not a straight path. So persevere.

I want to go into my old school and educate other on women in physics and attending university when you're from a deprived area and being a first generation uni goer.

Feedback from participants.



Figure 26 Discussing a demonstration.

Future Conferences

The participants' feedback suggests that the conference was highly successful in achieving its aims and that it would be worthwhile to organise future conferences for women undergraduates in physics in the UK. This section outlines a number of recommendations for the organising committee.

Application process

The application process continues to be a robust and transparent process, and the organising committee is to be commended on this. Although there were initial concerns about the number of applications, there were a good number of applications in the end. Publicity clearly needs to be led by the host institution, but all available channels of communication need to be utilised, and there is scope for this to be led by the IoP CUWiP Committee.

Experiences at the conference

The new organising committee put together a fascinating and varied programme which the participants enjoyed greatly. In particular, the committee should be commended on successfully running the event despite the Covid-19 situation. It was good to have contributions from women who have pursued careers in physics without post-graduate study. Catering for dietary requirements and other reasonable adjustments can be complex, particularly when being delivered by a contractor, and this may require additional oversight from the organising committee in future. It should be noted that if CUWiP is held during the Easter holidays in 2021, then it may well overlap with Ramadan, and participants observing the fast will need to be catered for accordingly. Finally, managing participants' expectations is always important – spreading the event across more days would significantly increase the cost, and hence the days will be packed as full as possible in order to give them as many experiences as possible. However, consideration of time to pack on the Sunday and ease of travel between accommodation and the conference venue is worth including in the planning of future events.

Overall, it was clear from the participants that the conference had provided them with a range of inspiring and valuable experiences which should have a positive impact on their future careers. Well done all!

Figure 27 Participants showed their commitment to physics through clothing!



These few days at the conference really helped improve my self confidence and solidify/ assure my reasons for taking physics and helped me know better what I could do in my own career.

The event was so positive and wonderful and, is a huge step in the right direction for women in physics.

I felt that the way the conference was run left me feeling completely cared for and nourished - women at their best.

Feedback from participants.

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Appendix One: Conference Programme

Thursday 12th March

18:00-19:00	Arrival and Registration	Exhibition Centre, University of York
19:00-19:15	Welcome talk by Dr Marina Petri	Exhibition Centre
19:15-20:30	Dinner	Exhibition Centre
20:30-22:00	Social Activities including a Quiz	Exhibition Centre

Friday 13th March

08:00-17:00	Excursions	1. Daresbury Laboratory (cancelled) 2. Hartlepool Power Station (cancelled) 3. AMRC, Sheffield and York Plasma Institute
18:00-19:00	Arrival back at the University and drinks reception	Exhibition Centre, University of York
19:00-20:15	Dinner	Exhibition Centre
20:30-20:50	Science for Peace at the Energy Frontier	Professor Daniela Bortoletto, Exhibition Centre
21:30	Travel back to hotel	Walk/public bus

Saturday 14th March

09:00-10:15	The discovery of pulsars – a graduate student’s tale	Dame Jocelyn Bell Burnell Exhibition Centre, University of York
10:15-10:30	Group photo	Exhibition Centre
10:30-11:00	Coffee Break	Exhibition Centre
11:00-12:30	Workshops	Exhibition Centre
	<ul style="list-style-type: none">• Engaging with the media• Find your future: CV and networking (cancelled as alumni not able to attend)• Meet a Medical Physicist• The Accumulation of (Dis)Advantage (or Nibbled to Death by Ducks)	
12:30-13:30	Lunch	Exhibition Centre
13:30-15:00	Workshops (as above)	Exhibition Centre
15:00-15:30	Coffee break	Exhibition Centre
15:30-16:45	Carbon is a girl’s best friend	Professor Petra Rudolf, Exhibition Centre
17:00	Travel back to Staycity	Public bus/walk

18:45	Travel from Staycity to National Railway Museum	Organised coach
19:00-19:30	Arrival and drinks reception	National Railway Museum
19:30-21:00	Dinner	National Railway Museum
21:00-22:00	After dinner keynote speaker	Sue Nelson, National Railway Museum
22:30	Travel back to Staycity	Organised coach

Sunday 15th March

09:00-09:30	Careers in physics – academia	Professor Marialuisa Aliotta, Exhibition Centre, University of York
09:30-10:30	Academic panel with Professor Marialuisa Aliotta, Professor Petra Rudolf, Professor Sarah Thompson, Dr Kate Lancaster	Exhibition Centre
10:30-11:00	Coffee break	Exhibition Centre
11:00-11:30	Careers in physics – industry	Heather Barton, Exhibition Centre
11:30-12:30	Industry panel with Heather Barton, Dr Sarah Dempsey, Samantha Wilkinson, Leah Morgan and Xanthe Jackson	Exhibition Centre
12:30-13:00	Fill out post-conference survey	Exhibition Centre
13:00-14:00	Networking lunch	Exhibition Centre
14:00	Depart York	



Figure 28 Group discussion.

12th - 15th March 2020
University of York

Deadline to apply: Friday 10th January 2020



There are a limited number of places available on CUWiP UK 2020! Deadline for applications is Sunday 02 February. Apply now!



CUWiP UK

Conference for Undergraduate Women in Physics UK

Exploring your Future in Physics

iop.org/CUWiPUK



Tours of world-leading industry facilities

Dinner at the National Railway Museum

Panel discussions with professionals and graduate students

Talks from leading female physicists including Professor Dame Jocelyn Bell Burnell and Professor Petra Rudolph

Photos from CUWiP UK 2019 by Kathryn Boast

