

HIGH SCHOOL OUTREACH BY POSTSECONDARY STUDENTS

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Why is the force of gravity so weak? Why are there three generations of matter particles? Why are their masses so different? These are some of the most interesting questions in particle physics, which, among many other areas like fusion power, nanotechnology, etc., are some of the most prominent in physics today. However, most material included in high school physics courses is pre-20th century classical mechanics, meaning many students are not exposed to these exciting ideas. Hence, reaching out to secondary schools with information about such areas is especially important. Bluteau and Barkanova [1] mention three major arguments in support of having this outreach performed by postsecondary physics students. Firstly, lessening the age gap between the students and the presenter may remove barriers caused by seniority and increase the quality of communication, as postsecondary students would have more recently gone through high school themselves. Secondly, another advantage to involving students as presenters is the valuable experience it gives to them, allowing for the development of important communication skills. Thirdly, having postsecondary students organize and perform science outreach eases the burden on professors who often have limited time due to their involvement in research as well as teaching.

Building upon this successful outreach program [1], presentations were organized again with a female undergraduate student. Female enrolment in physics in Canada is less than in many other areas in STEM, with only 22% of undergraduate physics degrees being earned by women in 2012 [2]. Research supports the importance of having female role models in motivating women to pursue STEM fields [3,4]. Thus, it was thought that having a female student performing the outreach could improve its effectiveness towards female students in particular. Like the

SUMMARY

We describe our approach to high school outreach. Our aim was to improve the effectiveness of this outreach towards female high school students.

reduced age gap, having a female presenter may remove barriers felt by female students.

METHOD

In the Spring of 2016, Acadia University honours student, Miriam Hewlett, who had previously started exploring subatomic physics research opportunities with Dr. Svetlana Barkanova, was funded by Women in Science and Engineering (WISE) Atlantic to visit nine high schools in Nova Scotia and provide over 350 students with an introduction to the field of subatomic physics. First, to help in introducing Hewlett to the teachers, we had an article published on Acadia's website [5] about her research and other interests, like volunteering for Acadia's Sensory Motor Instructional Leadership Experience (S.M.I.L.E.) [6]. Initially 45 teachers were contacted with an offer to come to their classes; however, we found that these "cold emails" often went unanswered, as only three replied, including Hewlett's previous high school teacher in Cape Breton. Following this result we turned to Dr. Lynn Aylward of Acadia University School of Education, with whom we had consulted about the presentation's structure, for help. Through Aylward's connections, Hewlett was able to get in contact with another of the local high schools and set up some more presentations. Following these visits, teachers were asked if they knew of anyone who might like to have a guest presenter. After hearing that they'd been mentioned by other teachers who had welcomed visits, teachers were much more likely to respond; in fact, all of the teachers contacted this way arranged for presentations to be given.

The majority of the presentations were given in grade 11 and 12 physics classes, but a less in-depth presentation was given to some students taking general science or math courses. The presentations consisted of a 45-minute lecture, with the majority of the time spent giving an introduction to the Standard Model. After covering this necessary background, some of the current research going on in particle physics was discussed, in particular the discovery of neutrino oscillations. A Nobel Prize in Physics in 2015 had been awarded to Dr. Arthur B. McDonald, originally from Sydney, NS, providing an excellent local role model for the students. Along with having a woman give the



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Misconceptions

- “I can’t do physics because I’m not an A+ student”
- “I can’t make a difference with physics”



Fig. 1 A sample of the material included in Hewlett’s presentation. Following an introduction to the Standard Model and research in particle physics, Hewlett shared her undergraduate experience and discussed some of the misconceptions students may have about pursuing a physics degree.

presentations, care was taken to include photos of successful female physicists. Students are more likely to pursue fields in which they believe they have a chance to succeed [7], so seeing the success of other women in physics is very important for female students. Lastly, Hewlett’s undergraduate physics experience, the future honours thesis she would be completing under the supervision of Barkanova, and possible careers in physics were also discussed. As mentioned by Aylward, “the idea that you have to be a ‘science person’ or an ‘arts person’ has to go” [8], so we emphasized that an interest in music or sports does not preclude one from becoming a physicist. Following the presentations there was also a question period where students had a chance to inquire about the material. This gave the students an opportunity to clear up some uncertainties they might have had about pursuing physics in university and as a career, and to hear this from a postsecondary student going through the process herself.

RESPONSE

The outreach was very well received by both teachers and students. The students were engaged and responded to the chance to ask about physics related questions unrelated to their class material, like the subject of gravitational waves, neutrinos, etc. Many students were also interested in taking physics in university and looked for advice. For example, some were interested about the advantages and disadvantages of going to a small

university like Acadia, and others worried that majoring in physics would require sacrificing time for other things like sports, volunteering, social activities, etc. Having an undergraduate student make a presentation and talk about their research opportunities and involvement in extra-curricular activities allowed for the chance to discuss these uncertainties in a very relatable context. The students were also very interested in what kind of careers would be available to them with a degree in physics; female students especially were curious about Hewlett’s plans after her undergraduate degree.

Following the presentations, teachers mentioned that it was beneficial to have students relate the subject that they were learning about in class to an exciting field like particle physics. Many of the grade 12 physics classes were just beginning their modern physics units, so the timing of the presentations worked well. It was also noted by one of the teachers that it was interesting to learn about some of the prominent roles currently filled by women in physics, specifically, in this case, about the current Director-General of CERN, Dr. Fabiola Gianotti.

CONCLUSION

There are many exciting fields in physics, as well as other sciences, that are often not touched on in high school. Outreach like this, done by an undergraduate student, is a great way to show high school students a glimpse of the possibilities available to them. Having a postsecondary student give these presentations has many advantages, especially in that it allows students to hear from a relatable source about studying physics in university. Furthermore, in hopes of improving its efficacy towards female students, this outreach was done by a female presenter and prominent female physicists were explicitly mentioned. We hope that this article may prompt a discussion about the employment of postsecondary students, especially female students, in outreach.

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