

Little Green Men: A Documentary Film about the Pulsar Search Collaboratory

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Pulsar Search Collaboratory

The NSF-ITEST Funded Pulsar Search Collaboratory (PSC) began in 2008 and is jointly managed by the National Radio Observatory (NRAO) and West Virginia University (WVU).



Fig. 1 PSC students in front of the Green Bank Telescope.

It involves middle- and high-school students in the search for pulsars in data taken with the the Green Bank Telescope (GBT) in Green Bank, WV (see Fig. 1). Pulsars are rapidly rotating, highly magnetic neutron stars born in the supernova explosions of massive stars. They have masses greater than that of our Sun and yet are only around 20 km in diameter. Due to conservation of angular momentum, they have incredibly short spin periods ranging from 14 ms to 8.5 s. Due to their high magnetic fields, billions of times greater than the Sun's, they emit pulses of radio waves similar to flashes of light from a lighthouse (see Fig. 2). Their phenomenal rotational stability makes them excellent laboratories for fundamental physics experiments. Among the most transformative of these is using a network of pulsars to directly detect gravitational waves, a key prediction of Einstein's theory of general relativity. This effort is the focus of the PI's NSF PIRE (Partnerships for International Research and Education) award (#0968296) and the associated research project for this CRPA funding. The importance of pulsar discoveries for gravitational wave detection, background on relativity and gravitational waves, and the international, diverse nature of this experiment will be highlighted in the film.

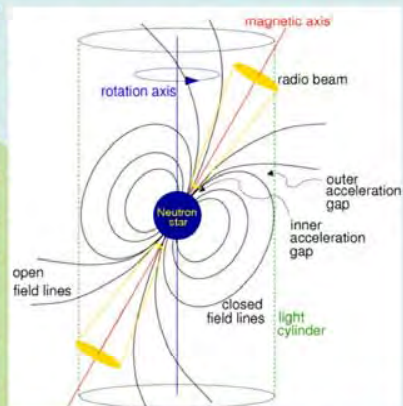


Fig. 2 Diagram of a Pulsar
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Impact of the PSC

Over six years, the PSC has involved more than 1700 students in 18 states. It has had a positive impact on career interests (see Fig. 3). Participation in the PSC is also positively correlated to students', particularly girls', confidence in their scientific aptitude, knowledge of the scientific process, and self-efficacy (see Fig. 4). The PSC has also been successful at attracting students who are typically under-represented in the sciences; roughly half of the current participants are female and 40% are from rural school districts.

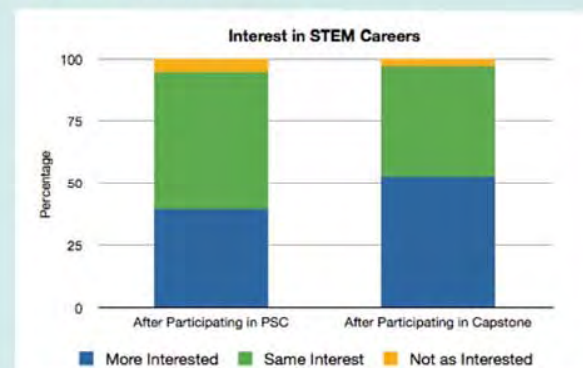


Fig. 3. Interest in STEM Careers after participation in the PSC

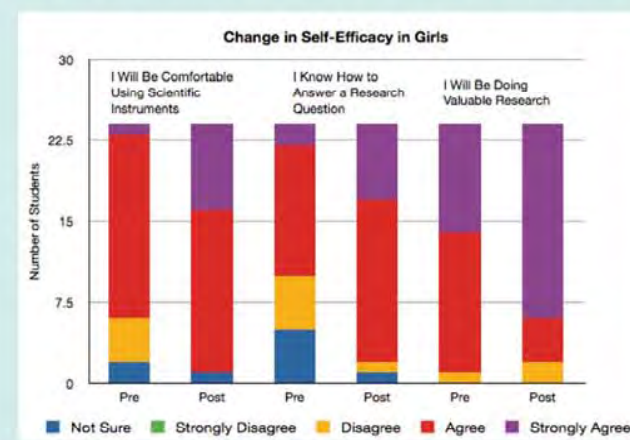


Fig. 4. Change in Self-Efficacy in girls after PSC participation

Little Green Men

Little Green Men will capture the participants' experiences and expand the reach and scope of the PSC. By exposing viewers to the students' enthusiasm and progress, the film will encourage youth to engage with the PSC and explore scientific majors and careers, while also encouraging adults to support such programs.



Fig. 5. A PSC student who discovered a radio transient with President Obama at a White House star party.

The Program

In our CRPA program, students will not only be viewing the film, seeing scientists (and student scientists) in action, and learning about pulsars. They will also be discussing the documentary with those in their classroom and community, as we plan to show the film in libraries, schools and museums. Students will also engage by participating in web-based activities and learning experiences, and possibly starting a PSC club of their own. The participation and engagement are thus expected to persist over time, outside of the classroom, with multiple groups of people, and through multiple media. The program will provide students with activities founded on the principles that have proven to lead to STEM interest, appreciation, engagement, participation, and academic success.

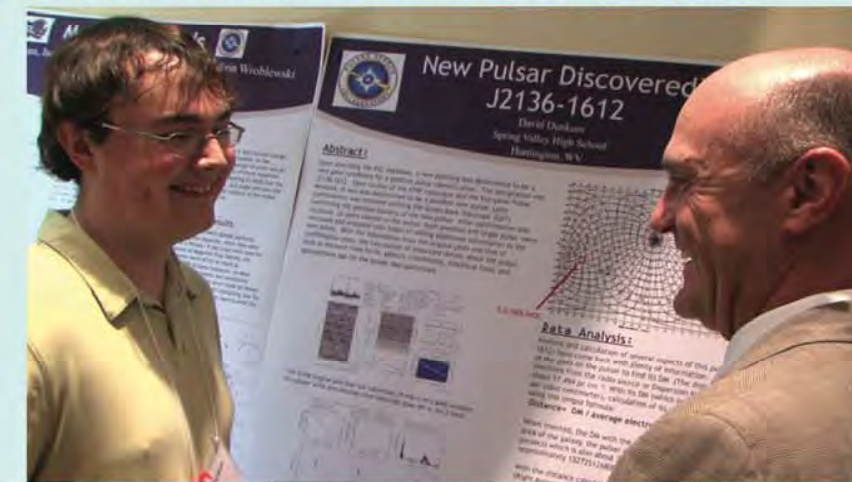


Fig. 6. A PSC student presenting a poster about his pulsar discovery to WVU President Jim Clements.

Audience

The film is targeted at a broad audience ranging from elementary-school students to senior citizens, though our main target audience is middle- and high-school students. Engaging students who are under-represented in science fields is one of the PSC's key objectives. By filming URM and female students engaged in the PSC, and through targeted dissemination in rural and urban areas, we hope to encourage viewers to identify with these students and realize that they too can be scientists. The PSC will also encourage first-generation college students to explore STEM majors. We also hope the film will show the general public the importance of the Green Bank Telescope and science funding, and foster an appreciation for the scientific process.



Fig. 7. McLaughlin and PSC students in the GBT control room.

Goals and Evaluation

Our evaluation will center on three main metrics. Does the documentary:

1. Increase scientific literacy in basic physics and astronomy?
2. Encourage students, especially those from under-represented groups, to pursue education and careers in science and technology-related fields?
3. Foster the development of similar programs in other scientific fields?

A front-end evaluation has been completed. Formative and summative evaluations will be completed over the next year.



Fig. 8. PSC students conducting research using the 40 Ft. radio telescope at Green Bank.

Challenges

A trailer for the documentary has been created, and we are currently in the process of editing the many, many hours of footage to create a feature length documentary. The main challenge has been keeping enough science in the film to accomplish the education aims, while also preserving the human interest angle to keep viewers entertained.

We aim to follow a few specific students through their PSC experiences so that viewers will see the substantial impact on these students, and to foster audience engagement with their stories. It is also a challenge to balance the stories of these particular students with the footage of the broader PSC experience as a whole. We are currently shooting supporting footage to fill gaps in the individual student experiences.

