Benjamin Hoscheit

**Award:** Undergraduate Student Research; $4000.00

**Status:** Junior, Astrophysics

**Advisor:** Peter Timbie

**Research Topic:** Exploring the Effects of Foreground Removal Techniques and Instrumental Systematics on Observations of the 21 cm Neutral Hydrogen Signal

**Abstract:** There is a substantial and growing interest in cosmology to study the 21 cm signal emitted or absorbed by large abundances of neutral hydrogen (HI) in the vast cosmic web of the universe. Such study has the potential to allow scientists to map the matter distribution of the universe over nearly its entire history. However, in order to unlock this rich potential, one must first develop the ability to distinguish and remove large contaminating signals from ionized gas in the foregrounds of the 21 cm signal. Furthermore, one must also have a dominant handle over the instrumental systematics associated with the particular experiment. As such, in this proposed research project, we first aim to understand and construct the associated ability to remove four common astrophysical foregrounds to 21 cm experiments utilizing the Singular Value Decomposition (SVD) Principal Component Analysis (PCA) technique. We then aim to assess the degree to which three common instrumental systematics introduce systematic un-smoothing effects into the analysis of these astrophysical foregrounds. This study will take place within a direct application to simulated Green Bank Telescope radio beam data and will be conducted over the upcoming summer in the Department of Physics at the University of Wisconsin-Madison.

**Biography:** Ben Hoscheit is a third year undergraduate student enrolled at the University of  
 Wisconsin-Madison (UW) majoring in Astronomy-Physics and Mathematics. His  
 research specializes in both theoretical and observational cosmology. He has been  
 involved in a theoretical research project advised by Professor Amy Barger in the UW  
 Department of Astronomy to further explore the potential cosmological implications of  
 observational data that suggest we may live near the center of a large void of size ~300  
 Megaparsecs. Furthermore, Ben has also been involved in an observational research  
 project advised by Professor Peter Timbie in the UW Department of Physics to study the  
 effects of foreground removal techniques and instrumental systematics on observations  
 of the 21-cm neutral hydrogen signal. His future goal is to pursue a doctorate degree  
 (PhD) in observational cosmology as a next step on the career path of science research  
 and education at the university level.

**Congressional District:** 2

**Congressional Representative:** Mark Pocan