Casey McGrath

**Award:** WSGC Graduate and Professional Research Fellowship; $5000.00

**Status:** Ph.D., Physics

**Advisor:** Jolien Creighton

**Research Topic:** Measuring Gravitational Wave Source Distances and Redshift from Pulsar Timing Arrays

**Abstract:** With the existence of gravitational waves now confirmed, it is expected that collaborations like NANOGrav will detect gravitational waves coming from sources such as supermassive black hole binaries (SMBHBs) within the decade. A major question to ask is how far away are these SMBHBs in our universe? The aim of my Ph.D. work has been to develop a bayesian-based simulation that can estimate gravitational wave source parameters such as luminosity distance from data of timing residuals taken from radio observatories. My current goal is to improve the simulation to also estimate the source’s parallax distance. Knowing both the source’s luminosity and parallax distances would allow the direct estimate the source’s redshift. Therefore, this would provide a new way of obtaining the distance-redshift relationship, independent of the cosmic distance ladder which is currently required. This gravitational wave based method could be very useful in the future to astronomers, and would compliment the electromagnetic based methods for measuring these cosmic distances, as well as test the validity of the cosmic distance ladder on the largest of scales.

**Biography:** Casey McGrath received his B.S. in physics and mathematics at the University of Redlands in California, with minors in astronomy and Spanish. He is currently pursuing a Ph.D. in physics at the University of Wisconsin Milwaukee, focusing on gravitational wave physics. A member of both the NANOGrav and LIGO collaborations, he is focused on research related to pulsar timing experiments. Currently, Casey is working on determining how a curved gravitational wavefront would affect and change the timing of pulsars we see in our Galaxy. Additionally, he helps lead the CoffeeShop Astrophysics public outreach program in his department, which gives monthly astronomy-related talks in a local coffeeshop.

**Congressional District:** 4

**Congressional Representative:** Gwen Moore