**Physics** & **Astronomy**

Colloquium

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**Dr. Caitlin Witt**

Northwestern University

**3:30 - 4:30 p.m. | Tuesday, Nov. 19**

**Science Building 234**

**Forging a Multi-Messenger View of Supermassive Black Hole Binaries**

Supermassive black hole binaries lurk deep within the cores of post-merger galaxies, and their identification represents the only key to unlock previously impossible probes of gravity, galaxy evolution, and the structure of the cosmos. While electromagnetic signatures probe plasma and gas in the environment around a binary, only pulsar timing arrays are currently sensitive to the low-frequency gravitational waves emitted directly by these slow-evolving giants. Pulsar timing array experiments have reached a critical turning point, and have recently announced that they have at last uncovered evidence of the stochastic gravitational wave background. The window to the gravitational-wave universe has been widened as we are now able to expand our view to include nanohertz gravitational wave frequencies, and will now turn our eye towards gravitational waves emitted directly by individual binary systems. Simultaneously, our electromagnetic capabilities to study the variable universe are on the brink of a new paradigm that will be opened by Rubin, Roman, and their dedicated surveys. In this talk, I will give an overview of electromagnetic, gravitational wave-, and multi-messenger studies of supermassive black hole binaries thus far. Then I will describe the possibilities for the road ahead, methods under development, and the next steps necessary to achieve a multi-messenger detection of a supermassive black hole binary and uncover the secrets of the variable universe.

**Refreshments at 3 p.m. | SC 103**