The University of Texas at Austin
Department of Physics
College of Natural Sciences

Colloquium

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John Archibald Wheeler Lecture Hall
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Neural mechanisms of physics reasoning and STEM anxiety

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Abstract

Understanding how students learn is crucial for helping them succeed, particularly in the science, technology, engineering, and math (STEM) disciplines. Yet innovations in transforming STEM education have been hampered by a fundamental lack of understanding of how neural changes enable learning. I will present recent results from an educational neuroscience study of 107 undergraduate students using functional magnetic resonance imaging (fMRI). First, we examined brain activity during physics reasoning to characterize underlying neural mechanisms and determine how these support comprehension and proficiency. We applied module analysis to response distributions, defining groups of students who answered using similar physics conceptions, and probed for brain differences linked with different conceptual approaches. Second, while anxiety is known to dysregulate large-scale brain networks, the impact of STEM anxiety has not been fully explored. We investigated the links between anxiety, resting state fMRI connectivity, and academic performance before and after a semester of physics, with an emphasis on how these relationships may differ for female and male students. I will discuss the results from both studies, offering insight into effective classroom and institutional practices to promote student success in physics.