SACRAMENTO STATE

Department of Physics and Astronomy

FALL 2025 Colloquium Series

Summer Research Experience

Sac State Physics Majors

Estimating Fake Tau's Using the Fake Factor Method HH -> bbTauTau

- **Jared Johnstun**

CERN is at the forefront of particle physics, testing and verifying the standard model that we've built across time. As a check against CERN's methods, Monte Carlo simulations of particles are used to test the particle reconstruction algorithms used on real collision data. But like any simulations, there's bound to be imperfections. In particular, for the Di-Higgs decay channel HH -> bbTauTau struggles from a major mismodeling of the Tau particle, and we call the mismodeled Tau's "Fake Taus". My main work over the summer was estimating how many of these Tau's were faked for the Run 2 data (and part of Run 3), and I'd love to talk with you all about it!

Exploring Student Graphical Reasoning with Eye-Tracking Technology

- **Braden Madden**

By applying the Dual Process Theory of Reasoning (DPToR) to eye-tracker data conclusions can be drawn about students' graphical reasoning. The DPToR describes how intuition, reasoning, and experience interact in order to solve problems. The DPToR gives this project a unique and powerful theoretical framing that allows meaningful interpretation of data. Out of 33 articles studied in a lit review "less than half of the articles explicitly reported a (cognitive) theoretical anchoring of the eye-tracking method" [L. Hahn and P. Klein Physical Review Physics Education Research 18, 013102, 2022]. All of these articles were citing studies that indicated the focus point of a student determines what they are thinking about. This research combines this "eye-mind assumption" [Just and Carpenter Psychol. Rev. 87, 329, 1980] and the DPToR to establish a cognitive theoretical anchoring of problem solving and behavior that allows meaningful interpretation of student eye-tracker data.

The Z-Axis GMR-Sensor: Feasibility and Prototyping

- **Rocco Marshall**

Many modern implantable medical devices—such as defibrillators, pacemakers, and others—rely on Giant Magnetoresistance (GMR) sensors for communication and MRI safety. However, with new technological innovation come new challenges. This talk will cover the physics of the GMR effect, the design and manufacturing of a GMR sensor whose axis of sensitivity is oriented perpendicular to the surface of the PCB on which it is mounted, as well as the feasibility testing of a third party's proposed design solution.

Thursday, Sept. 11, 2025

4:00 - 5:20PM

MND1015

Open & Free to all students, faculty and public