SACRAMENTO STATE

Department of Physics and Astronomy

SPRING 2025 Colloquium Series

Senior Project Talks

Sac State Physics and Astronomy Majors

Probing the Quenching Effect on Star Formation in Simulated Giant Molecular Clouds due to Modeling Turbulence

- **Jackson Abello**

Simulated galaxies display star formation rates considerably higher than observed analogues. One proposed explanation for this is that gas turbulence on scales smaller than the simulations' resolutions quenches star formation. We test several different models for turbulent star formation (TSF) in a giant molecular cloud (GMC) using a version of smoothed-particle hydrodynamics code GASOLINE. We found that within a time interval 3 times that of the GMC's freefall time, most TSF models yielded near-total quenching of star formation, but one model only reduced star formation by roughly an order of magnitude.

Commissioning of the Four Jig Setup with Preparation for Loaded Module Cell Production

- **Rocco Marshall**

To prepare for the upgraded High-Luminosity Large Hadron Collider, the ATLAS Detector will replace its current Inner Detector with an all-silicon Inner Tracker (ITk) consisting of both pixel and strip modules. The Pixel subsystem contains 9,400 individual pixel modules for covering a 13 m^2 area and giving x-y-z position data for every particle that passes through. Each pixel module must be rigorously tested to ensure it is working properly before installation as they will be inaccessible once the ITk is installed. This work presented in this presentation covers the commissioning of the four-jig setup with preparation for loaded module cell production. The four-jig setup is the new quality control setup for the pixel modules, and tests pixel health, pixel failure, and leakage current. The presentation features the IV Test in Parallel, Comparison of all Jigs, and Black Blanket and Ground Comparison which verify that the jig can be used for up to four modules in parallel during quality control testing for the ITk pixel modules. It also includes the Module Cooling Comparison and the Canopy Resistance Measurements which identify some key issues with the carriers and the canopies.

Simulating the Cosmos: Insights into Jets from Compact Mergers

- **Ethan Potter**

This presentation explores relativistic jets from compact object mergers, with a focus on their energy distribution as a function of the polar angle θ (the angle from the core-axis of the jet). Using HARMPI, a parallelized MHD simulation tool, we model a black hole-torus system formed in the aftermath of a binary neutron star merger. The accretion disk surrounding the black hole generates powerful magnetohydrodynamic (MHD)--driven jets launched through the interaction of magnetic fields and intense gravitational forces. By analyzing the simulation data, we extract and visualize the jet's total energy (E_tot), Lorentz factor (Γ), and magnetization (σ) as functions of θ. This will give us insights into how the jet evolves, allowing us to use these jet models for much later events in the jet's life, such as the prompt emission, and give us a better understanding of the central engine of the black hole.

Thursday, May 1, 2025

4:00 - 5:20PM

MND1015

Open & Free to all students, faculty and public