Sacramento State Department of Physics and Astronomy

Thursday, October 1, 2020 | 4:00 – 5:20PM

Please, visit csus.edu/physics for more information on how to access the colloquium virtually.

Open and free to all students, faculty and public

The Journey of Relativistic Astrophysical Jets

Dimitrios Giannios

Associate Professor

Purdue University

Abstract:

When black holes are fed gas by their environment, they convert gravitational energy into radiation extremely efficiently and, surprisingly, eject plasma in the form of powerful collimated flows at a speed close to the speed of light, producing "relativistic jets". Relativistic jets are observed to emerge from super-massive black holes located at galactic centers but also theorized to mark the merger of neutron stars powering gamma-ray bursts. When pointing towards Earth, relativistic jets are spectacular sources that outshine their host galaxy and show extremely bright, broadband flares on very short timescales. Furthermore, the compact object merger process makes for a powerful source of gravitational waves, detectable by the LIGO and VIRGO observatories.

The common hypothesis for formation of jets is that they are launched by magnetic fields that thread the black hole and the surrounding gas. I will discuss the journey of the jet from its birth place (the black hole) to the much larger scales (the radiation phase). I argue that the jet radiation is result of instabilities in the jet that result in dissipation of energy through the process of magnetic reconnection; a process similar to the one that powers the solar flares. I will present my team's first-principle simulations showing how the magnetic reconnection in the jet plasma can account for the jet flares. Finally, I will discuss the latest developments in the field where a merger of two neutron stars was detected by its gravitational waves and subsequently observed throughout the electromagnetic spectrum.

Event supported by the National Science Foundation.

NSF

SACRAMENTO STATE