MONTANA STATE UNIVERSITY | College of LETTERS & SCIENCE

Physics Colloquium

Friday, September 29th
4:10 – 5:00 PM
Barnard Hall 103

Exploring Cosmic Mysteries with Cosmological Simulations: Theoretical Insights from Active Black Holes in Dwarf Galaxies

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Abstract: Virtually all large galaxies, like our galaxy the Milky Way, harbor massive black holes at their centers. Some of these black holes appear to the observer as 'active galactic nuclei' since they are growing by devouring gas which releases vast amounts of energy. Improved technology has recently enabled astronomers to also detect active black holes in small galaxies (so-called dwarf galaxies). This has prompted a paradigm shift as black holes had previously been completely neglected in dwarf galaxy models. Motivated by these tantalizing observational results, we have performed a cosmological simulation suite of dwarf galaxies with active galactic nuclei. The goal is to determine whether black hole activity could shut down the metamorphosis of gas into stars in dwarfs since a feedback mechanism is needed to prevent excessive star formation and match observations. Previously, supernovae had been assumed to be the main feedback mechanism in dwarfs. However, whether supernovae alone can bring dwarf galaxy simulations into agreement with observations is still controversial. We find that black hole feedback has a crucial effect on the gas outflows emanating from the galaxy, significantly increasing outflow velocities and temperatures. These boosted outflows can suppress fresh gas inflows from the cosmological environment and shut down star formation by depleting the gas reservoir of the dwarf galaxy, demonstrating that active black holes could play a vital role across the whole galaxy population. Finally, I will discuss some recent advances in the theoretical treatment of active black holes with a special focus on improving shortcomings of the current models when applied in the early Universe – a largely unknown regime that is currently being uncovered by the JW Space Telescope.

Host: Amy Reines

**** Refreshments served in the Barnard second floor atrium at 3:45. ****