SPEAKER:  Dr. Lindsay LeBlanc, University of Alberta

TOPIC:  *Light-Matter Interactions in Cold and Ultracold Neutral Atomic Gases: Applications to Quantum Technologies*

DATE:  Tuesday November 28th, 2023

TIME:  3:30-4:30 p.m.

PLACE:  Physics 103

Abstract:

Neutral atomic gases provide fantastic opportunities for studying and controlling quantum phenomena, ranging from many-body physics to quantum computers. In our research, we use the well-known interactions between cold gases and electromagnetic radiation to harness various quantum degrees of freedom. Quantum memories, used for storing and manipulating photonic signals, will be a key component in quantum communications systems, especially in realizing critical quantum repeater infrastructure. Cold atoms have significant potential as high performance spin-wave quantum memories, due to the long storage times associated with low temperature and slow thermal diffusion. In our work, we demonstrate two memory protocols in ultracold (sometimes Bose-condensed) atoms, which hold the potential for high-performance light storage: the Autler-Townes splitting (ATS) and superradiant approaches. These methods provide a path towards practical implementations in both ground- and satellite-based quantum communications systems, and we are working on both increasing performance and developing practical implementations. In other directions, our lab also uses ultracold ensembles to study unconventional quantum gates for quantum computing, and warm vapours in microwave cavities to exploit simultaneous microwave and optical transitions.