SEMINAR NOTICE

Department of Physics and Engineering Physics
University of Saskatchewan

SPEAKER: Dr. Robin Kleiv,
Dept of Physical Science, Thompson Rivers University, Kamloops

TOPIC*:* *Quark Clustering in Exotic Hadrons: Insights from QCD Sum Rules.*

DATE: Tuesday September 16th, 2025

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

PLACE: ***Physics 103*** *(Dr. Kleiv will be zoomed in.)*

Abstract:

Hadrons are composite states of quarks and gluons, bound together by the strong interaction. Conventional hadrons include baryons, such as the proton (three quarks), and mesons, such as the pion (a quark and an antiquark). Over the past two decades, experiments including LHCb, Belle, and BESIII have uncovered many non-conventional hadrons, including tetraquarks (two quarks and two antiquarks) and pentaquarks (four quarks and one antiquark). These discoveries challenge our understanding of how quarks arrange themselves inside hadrons, and determining their internal structure remains an open problem.

One useful framework is the diquark picture, where quark pairs form clusters that serve as building blocks for larger states. This approach offers a simplified description of multiquark systems and an intuitive way to interpret exotic hadrons. To connect these ideas to theory, I employ the method of Quantum Chromodynamics (QCD) sum rules, which relates quark- and gluon-level dynamics to measurable hadron properties.

This talk will provide an introduction to quarks, color, QCD, diquarks, and the QCD sum rule method. I will then highlight results on heavy–light and doubly-heavy diquarks, as well as SU(3) flavor-breaking effects for heavy-light diquarks. Finally, I will discuss ongoing work on bottom–charm diquarks and outline new research on triquarks, with applications to the structure of pentaquarks.