



University
of Victoria

PHYSICS AND ASTRONOMY SEMINAR (In-Person)

Dr. Christopher Charles
TRIUMF

“Particle Accelerator Chemistry: Radiolytic Production of Organic Molecules and Emergence of Life in Extreme Planetary Environments”

Abstract

The oldest known water on Earth (> 2 Gyr) was found at Kidd Creek Mine in Timmins, ON, Canada, at an extreme 2.4 km depth. The complex geochemistry and isotopic compositions of these waters shows an isolated, distinct, and unique evolution away from the global meteoric water cycle. It begs to reason that other planetary bodies throughout our Solar System (i.e. Mars, Enceladus, Europa) and perhaps even exoplanets may also have subsurface liquid water at extreme depths, isolated over geologic timescales. As far as we know, life requires the presence of: (1) liquid water, (2) conditions favouring assembly of complex organic molecules, (3) energy sources for chemical reactions and/or to sustain metabolic process, and (4) time. Whether life or conditions favouring life could have evolved naturally, or not, in such extreme subsurface environments is a major unresolved question.

In this talk I describe our novel, non-traditional use of the TRIUMF accelerator systems and techniques to study the radiolysis of water – and the possible role of radiolysis as an energy source and mechanism to drive the natural formation of complex organic molecules from inorganic starting components, at extreme depths inside planetary bodies.

Friday, March 07, 2025

2:00pm PST

ECS 104