SEMINAR NOTICE

Department of Physics and Engineering Physics
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SPEAKER: Dr. Émile Carbone
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TOPIC*:* ***Driving chemical reactions using renewable electricity in non-equilibrium Plasmas***

DATE: Tuesday February 1st, 2022

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

PLACE: ***Zoom***

Zoom: https://usask-ca.zoom.us/j/95406349199?pwd=VVgwbVJNam9yQUo0VG5MR0NCbkFtZz09

ABSTRACT:

Chemical synthesis of fuels using sustainable energies is one of the main challenges for the development of a circular economy. In recent years, because of their flexibility and capability of not using any rare earth materials or noble metals, atmospheric pressure non-equilibrium plasmas have been the focus of intense research activities for the reduction of stable molecules such as CO_2 and N_2 as well as the production of H_2. Plasmas enable chemical and physical processes which are not accessible via classical (i.e. thermal) processes and are at the core of various technologies used in everyday life such as smartphones, lamps, textiles, air purification, medicine (sterilization, cancer treatment, wound healing,…) and agriculture (nitrogen fixation, seed germination and growth,…). While developing a new technology, a set of criteria need to be defined to make a fair assessment while comparing with other methods. As an example, this seminar will discuss the reduction of CO_2 using high frequency discharges (namely radio-frequency and microwave plasmas) and H_2 production from methane. Depending on plasma parameters such as the electron density and temperature, the gas and vibrational temperatures, the dissociation and recombination pathways of molecules are completely different in atmospheric pressure plasmas. To enhance the energy and conversion efficiencies, the experimentalist has a number of tools to achieve this goal, mainly while controlling the reduced electric field and deposited power density, both through the applied frequency and applicator geometry, and via the input gas flow. The basic physics of non-equilibrium plasmas will be given together with a techno-economical assessment.