

SEMINAR NOTICE

Department of Physics and Engineering Physics
University of Saskatchewan

SPEAKER: Dr. Alexey Shevyakov
Department of Mathematics and Statistics

TOPIC: *Nonlinear wave dynamics in fluids and solids: theory, computation, and applications*

DATE: Tuesday October 6th, 2026

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

Room: **Phys 103**

Nonlinear waves arise in settings ranging from stratified fluids and biological membranes to the Earth's crust and space plasmas. Their propagation characteristics can depend on the wave shape itself, sometimes making an initially smooth profile steepen and develop a sharp front in a finite time. Competing effects, such as dispersion and viscosity, can instead produce persistent traveling waves, oscillatory wave trains, or smooth dissipative fronts.

This talk explores these dynamics through examples from our work on internal fluid waves, nonlinear elastic and viscoelastic shear waves in soft solids and fiber-reinforced membranes, and Love waves in layered media. We combine mathematical analysis and numerical simulation to follow waves from smooth propagation to breaking and beyond. Exact traveling-wave solutions and the method of characteristics reveal how wave shape determines propagation and breaking. Multiple-time-scale approximations describe the cumulative effects of weak nonlinearity, remove secular growth, and predict breaking times. Conservation laws connect these approaches: they constrain wave dynamics, guide the treatment of discontinuities, and provide both design principles and accuracy checks for numerical schemes.