Wave Phenomena and Partial Differential Equations
(Org: **George Shaohua Chen** (Cape Breton University), **Ming Mei** (McGill University & Champlain College St-Lambert) and/et **Chunhua Ou** (Memorial University))

JOSE PALACIOS ARMESTO, University of Toronto
Asymptotic Stability of peakons for the Novikov equation

The Novikov equation is an integrable Camassa-Holm-type equation with a cubic nonlinearity. One of its most important features is the existence of peaked traveling waves. In this talk, we will prove the asymptotic stability of those peakon solutions, under $H^1(\mathbb{R})$-perturbations satisfying that their associated momentum density defines a non-negative Radon measure. In order to do that, we first prove a rigidity theorem, sometimes called Liouville theorem. The main novelty in our analysis, compared to that of the Camassa-Holm case, comes from the fact that the momentum is not a conserved quantity anymore. To overcome this problem, we introduce a new Lyapunov functional unrelated to the (non-conserved) momentum of the equation.

ELENA BRAVERMAN, University of Calgary
Trimming harvesting strategies to natural dispersal for spatially heterogeneous populations

Defining a diffusion strategy as the tendency to have a distribution proportional to a certain positive prescribed function, once a diffusion coefficient grows infinitely, we explore the influence of harvesting policies on the competition outcome. The talk is focused on the interplay of heterogeneity, variable diffusion strategies and space-dependent populations management, either harvesting or management combining possible relocation, culling and stocking.

GEORGE SHAOHUA CHEN, Cape Breton University
Improved blowup time estimate for fourth-order damped wave equation with strain term at arbitrary positive initial energy

By proposing a new differential inequality, we improve the upper bound of the blowup time estimate for the nonlinear fourth-order damped wave equation with strain term at arbitrary positive initial energy. We also give two new initial conditions to expand the range of the initial data leading to the finite time blowup of solutions. We obtain a sharp result of finite time blowup for the special case of the new differential inequality. Some simulations exhibit and verify the main results.

GAEL YOMGNE DIEBOU, University of Toronto
Non-blow up at large times and stability of global solutions to nematic liquid crystal flow

The flow of nematic liquid crystals is modeled by a system coupling the incompressible non-homogeneous Navier-Stokes equations and the transported harmonic maps heat flow to $\mathbb{S}^2$. An almost optimal global well-posedness result was established by Wang [11'] for small initial velocity and orientation field in BMO^{-1} and BMO, respectively. In this talk, I will discuss the stability question for a priori global solutions. Large solutions are shown to be small at large times, a property which is inferred by the geometric condition. The role of this smallness property in the stability result will be highlighted.

WEIYANG LI, Memorial University of Newfoundland
Liouville-type Laws for $-\Delta_m u + |\nabla u|^q = f(u)$ in Exterior Domains of $\mathbb{R}^N$

In this talk, I will introduce the Liouville type theorems for the m-Laplacian equation with gradient term $-\Delta_m u + |\nabla u|^q = f(u)$ in exterior domains of $\mathbb{R}^N$. Here $q > m-1$ and the function f satisfies $f(s) > cs^p$ near zero where c is a positive constant. This is based on a joint work with Yuhua Sun and Jie Xiao.

MING MEI, Champlain College St.-Lambert
Threshold convergence results for nonlocal time-delayed diffusion equations

In this talk, we consider the asymptotic behavior for nonlocal dispersion Nicholson blowflies equation. By the method of Fourier transform, we first derive the decay estimates for the fundamental solutions with time-delay. Then, we show the threshold results with optimal convergence rates for the original solution to the constant equilibrium. The lower-higher frequency analysis plays a crucial role in the proof. This talk is based on a recent joint work with Rui Huang and Zhuangzhuang Wang published in J. Differential Equations (2023).

HOLGER TEISMANN, Acadia University
Dispersion as an obstruction to the bilinear control of Schrödinger equations

The control of quantum systems is an area of intense theoretical and experimental study with significant potential ramifications for technology, of which quantum computing is only the most widely publicized one. The present paper is part of a project on identifying limitations to what can be accomplished by the application of classical fields, in particular whether control can be achieved in arbitrarily small time. The fundamental equation of quantum theory, the Schrödinger equation, is a dispersive PDE. The purpose of this talk is to demonstrate that dispersion can act as an obstacle to controllability that prevents a large class of quantum systems (defined by decay or integrability conditions of the potential) from being controllable in finite time. There is also a large class of systems that cannot not even be controlled in infinite time.

GANTUMUR TSOGTGEREL, McGill University
Elliptic estimates for operators with rough coefficients

In this talk, we will present a new elementary approach to establishing elliptic estimates for a class of operators with rough coefficients, in the Triebel-Lizorkin and Besov scales. This is is a joint work with Mike Holst (UCSD) and David Maxwell (UAF).

XINWEI YU, University of Alberta
Some new regularity criterions for the 3D incompressible Navier-Stokes equations

In this talk we discuss several regularity criterions for the 3D incompressible Navier-Stokes equations, including several new classes of Prodi-Serrin type criterions, as well as a new type of geometrical conditions on the super level set of the velocity magnitude that guarantees regularity. This is a summary of joint work in recent years with Prof. Chuong V. Tran of the University of St. Andrews, Scotland, and Mr. Benjamin Pineau of the University of Alberta (Now at UC Berkeley).

YUANXI YUE, Memorial University of Newfoundland
Traveling wavefronts to a model of precursor and differentiated cells

This talk presents a comprehensive analysis of the rich and complex propagation dynamics to a model of precursor and differentiated cells, with the appearance of non-isolated equilibria on a line in the phase space. We established the existence of traveling waves in the monostable monotone case by means of continuation argument via perturbation in a weighted functional space, by applying the abstract implicit function theorem. We provided necessary and sufficient conditions of the minimal wave speed selection and proved the existence of the transition (turning point) k^* for the minimal wave speed when the parameters λ and γ are fixed. Two explicit estimates about k^* were given. We investigated the decay rate of the minimal traveling wave as $z \to \infty$ in terms of the value of k. We further proved the existence of non-negative wavefronts in the monostable non-monotone case and found that the minimal wave speed is always linearly selected. Finally, in the bistable monotone case, the existence and uniqueness of bistable traveling waves were proved via constructing an auxiliary parabolic non-local equation.