Prize Lectures

DR. QIN DENG, Massachusetts Institute of Technology
Non-branching on metric measure spaces with Ricci curvature bounded below

On a smooth Riemannian manifold, the uniqueness of a geodesic given initial conditions follows from standard ODE theory. In this talk, I will extend a version of this result to the setting of RCD(K,N) spaces, which are metric measure spaces satisfying a synthetic notion of Ricci curvature bounded below first introduced by Sturm-Lott-Villani. To do so, I will also generalize a well-known result of Colding-Naber concerning the Hölder continuity of the geometry of small balls along geodesics to this setting.

DR. JACQUES HURTUBISE, McGill
Gauge theory, looking back.

(or the Uses of instantons, with apologies to Sidney Coleman) When giving a talk linked to a career award, the obvious option is to review one's own work. This can unfortunately be quite dull. Instead, I will try to review the evolution of a subject whose rise to prominence coincides roughly with the start of my career and which has insinuated itself into a surprising number of subjects of mathematics.

DR. JOHN MIGHTON, Jump Math
Solving the problem of equality with math

New research in cognitive science suggests that math may be the most universally accessible and the most important subject for young brains. But a decade of significant investments in new technologies and curricula hasn't significantly improved outcomes in math. We will discuss potential solutions to this problem including some key findings from the science of learning that could help us nurture the full intellectual potential of every student and create a more equitable and productive society.

DR. FABIO PUSATERI, University of Toronto
Nonlinear PDEs with potentials and the stability of Solitons and Kinks

Solitons are coherent structure that emerge from the balance of linear restoring forces and nonlinear focusing interactions in many physical models. They play a key role in our understanding of complex nonlinear systems and their time evolution. While the literature on classical (spatially localized) Solitons is very extensive, much less is known about Topological Solitons, which are typically non-localized structures. The simplest example of a Topological Soliton is a 1 dimensional 'Kink', a stationary solution which connects two different trivial states at plus and minus infinity.

The starting point for the analysis of all these coherent structures is the linearization of the equations in their vicinity. This naturally leads to study nonlinear evolution equations of wave/dispersive-type with large potentials. In this talk we will give an introduction to this class of problems, and present some recent results with applications to the stability of kinks and Solitons, and to the phenomenon of "Radiation Damping". Our general approach is based on the use of the distorted Fourier transform, that is, the Fourier transform adapted to a Schrödinger operator, and the development of multilinear Harmonic Analysis in this setting.

This talk is based on joint works with P. Germain (Imperial), F. Rousset (Paris-Saclay Orsay), A. Soffer (Rutgers), G. Chen (Georgia Tech), T. Léger (Princeton), Z. Zhang (NYU), A. Kairzhan (U of Toronto).