



Pacific Institute *for the*  
Mathematical Sciences

## The 12th Annual Alberta Colleges Mathematics Conference and North/South Dialogue in Mathematics

May 3 - 4, 2012

Campus Saint-Jean  
University of Alberta, Edmonton



Invited Speakers for the Alberta Colleges Mathematics Conference – May 3rd

Dr. Jean-Marie De Koninck, Université Laval

Dr. Anna Stokke, University of Winnipeg

Invited Speakers for the North South Dialogue in Mathematics – May 4th

Dr. Jean-Marie De Koninck, Université Laval

Dr. Robert McCann, University of Toronto

Dr. Alexander Melnikov, University of Alberta

### GENERAL PROGRAM



Pacific Institute *for the*  
Mathematical Sciences  
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## May 3<sup>rd</sup>, 2012 - Alberta College Mathematics Conference

Hours	Items	Rooms	Chair
08:00 – 16:00	Registration	Lobby Mc Mahon Bldg	
09:00 – 09:15	Opening	Auditorium	
09:15 – 10:15	Public lecture : Anna Stokke	Auditorium	Hassan Safouhi
10:15 – 10:30	Coffee break / snack	Cafeteria	
10:30 – 12:30	Contributed talks 1. <i>Kris Reid</i> 2. <i>Pamini Thangarajah</i> 3. <i>Manny Estabrooks</i> 4. <i>Peter Zvengrowski</i>	Room 1-01 Pav. MCM	Peter Zizler
12:30 – 14:00	Lunch	Cafeteria	
14:00 – 16:00	Contributed talks 1. <i>Roberta La Haye</i> 2. <i>Peter Zizler</i> 3. <i>Josey Histesman</i> 4. <i>Higher Education Pearson Canada</i>	Room 1-01 Pav. MCM	Pamini Thangarajah
16:00 – 16:15	Coffee break / snack	Cafeteria	
16:15 – 17:15	Panel discussion Technology in Teaching and Learning Activities	Lacerte 3-04	Manny Estabrooks
17:30 – 18:30	Public lecture : Jean-Marie De Koninck	Auditorium	Hassan Safouhi
18:30 – 21:30	Banquet	Grand Salon	





## May 4<sup>th</sup>, 2012 - North South Dialogue in Mathematics

Hours	Items	Rooms	Chair
08:00 – 12:00	Registration	Lobby Mc Mahon Bldg	
09:00 – 10:00	Plenary Lecture : Jean-Marie De Koninck	Auditorium	Hassan Safouhi
10:00 – 10:15	Coffee break / snack	Cafeteria	
10:15 – 11:45	Parallel Sessions: General session 1. <i>Eric Roettger</i> 2. <i>Timur Akhunov</i> 3. <i>Brendan Pass</i> Math Finance 1. <i>Christoph Frei</i> 2. <i>Kaijie Cui</i> 3. <i>Hao Li</i> Students session 1. <i>Richard M. Slevinsky</i> 2. <i>William Davis</i> 3. <i>Amanda Swan</i>	Room 1-01 Pav. MCM  Room 2-66 Pav. MCM  Room 1-64 Pav. MCM	William Hackborn  Alexander Melnikov  Patrice Rivard
11:45 – 13:15	Lunch	Cafeteria	
13:15 – 14:15	Plenary Lecture by Robert McCann	Auditorium	Thomas Hillen
14:15 – 15:15	Plenary Lecture by Alexander Melnikov	Auditorium	Thomas Hillen
15:15 – 15:30	Coffee break / snack	Cafeteria	
15:30 – 17:00	Parallel Sessions: General session 1. <i>Ami Viselter</i> 2. <i>Cristian Ivanescu</i> 3. <i>Ashok Krishnamurthy</i> Math Finance 1. <i>Ke Zhao</i> 2. <i>Shuo Tong</i> 3. <i>Babacar Seck</i> Students session 1. <i>Maryam Khajeh Alijani</i> 2. <i>Peng Du</i> 3. <i>Vlad Gheorghiu</i>	Room 1-01 Pav. MCM  Room 2-66 Pav. MCM  Room 1-64 Pav. MCM	Elaine Beltaos  Alexander Melnikov  Patrice Rivard
7:00 - 17:15	Closing	Room 1-01 Pav. MCM	



## May 3<sup>rd</sup>, 2012 - Alberta College Mathematics Conference

### **Public Lectures** Room 1-08 Auditorium McMahon Pavilion

<b>Public Lecture 1</b>	
Speaker	Anna Stokke – <a href="mailto:a.stokke@uwinnipeg.ca">a.stokke@uwinnipeg.ca</a>
Institution	Department of Mathematics & Statistics, University of Winnipeg
Title	What's happening with K-12 math education?
Abstract	Math education at the K-12 level has become a heated topic in Canada, particularly in Manitoba and Saskatchewan, over the past few months. I will discuss the main issues: teacher preparation in math and math curricula. I will detail our efforts to bring about positive changes and discuss the need for mathematicians to become involved. This lecture will be of interest to mathematicians, teachers, parents and anyone who is concerned about math education in Canada.

<b>Public Lecture 2</b>	
Speaker	Jean-Marie De Koninck – <a href="mailto:Jean-Marie.DeKoninck@mat.ulaval.ca">Jean-Marie.DeKoninck@mat.ulaval.ca</a>
Institution	Department of mathematics and statistics at Université Laval
Title	<b>The Secret Life of Mathematics</b>
Abstract	<p>Most people don't realize that mathematics is everywhere. In this talk, through a variety of examples, we will lift the veil on the secret life of mathematics. For instance, we will show that using the famous Poisson Law in probability theory, one can establish that the team that scores the first goal in a soccer match will end up losing the game only in 14% of the cases.</p> <p>In 2010, two Canadian mathematicians used an objective statistical analysis to show that teams that are trailing in a hockey game should pull their goaltender much earlier than what is common practice.</p> <p>Your doctor tells you that your last blood test confirms that you have a very rare disease (only 1 out of 200 people have it); he also tells you that the test is reliable in 96% of the cases; should you be worried? According to Bayes' theorem, you should not!</p> <p>We now know that the safest exits on a highway are those whose shape is that of a certain spiral.</p> <p>These and other topics will demonstrate that mathematics is everywhere and therefore cannot be ignored.</p>



**General Session**  
**Room 1-01 McMahon Pavilion**

<b>Contributed Talk 1</b>	
Speaker	Kris Reid – <a href="mailto:kris.reid@gov.ab.ca">kris.reid@gov.ab.ca</a>
Institution	Alberta Teachers
Title	The Alberta Kindergarten to Grade 12 Revised Mathematics Programs of Study
Abstract	Alberta Education, in collaboration with education stakeholders including teachers, administrators, parents, business representatives, post-secondary institutions, has recently revised the Mathematics program of studies for Kindergarten to Grade 12. The final year of implementation begins in September 2012 with the Grade 12 courses. The revised program focuses on developing a deep, conceptual understanding of the topics and instilling mathematical processes which will prepare all students for the mathematical thinking that they will require in the future. This presentation will focus on the rationale behind the program revision, some key characteristics of the revised program, and the supports for implementation in Alberta for teachers, students and parents.
<b>Contributed Talk 2</b>	
Speaker	Pamini Thangarajah – <a href="mailto:pthangarajah@mtroyal.ca">pthangarajah@mtroyal.ca</a>
Institution	Department of Mathematics, Physics and Engineering, Mount Royal University
Title	Motivating students with examples through collaborative research
Abstract	We will explore how the collaborative research contributes to motivational examples for teaching.
<b>Contributed Talk 3</b>	
Speaker	Manny Estabrooks – <a href="mailto:Manny.Estabrooks@rdc.ab.ca">Manny.Estabrooks@rdc.ab.ca</a>
Institution	Mathematics & Statistics, Red Deer College
Title	The Inverted Classroom
Abstract	So they think they can get rid of the classroom in College & University education! The presenter has undertaken to put on line a series of 40 video presentations for courses in Calculus, Statistics and Math of Elementary School Teachers. Accompanying this is a workbook to parallel the video material with additional problems. This presentation will focus on student success in these courses and the role of the instructor in the classroom setting.



**General Session, suite  
Room 1-01 McMahon Pavilion**

<b>Contributed Talk 4</b>	
Speaker	Peter Zvengrowski – <a href="mailto:zvengrow@ucalgary.ca">zvengrow@ucalgary.ca</a>
Institution	Department of Mathematics and Statistics, University of Calgary
Title	The Alberta Calculus Protocol 11x11x11 Meeting
Abstract	At the 2011 North-South Dialogue, held at Mt. Royal University, an initiative was undertaken to hold a weekend meeting at BIRS (Banff International Research Station) that would focus on the teaching of Calculus (primarily) in Alberta. At this point it would be good to thank Manny Estabrooks of Red Deer College, who was primarily responsible for this initiative and the subsequent successful proposal to BIRS. The meeting took place at BIRS on November 11, 2011 (hence the nice $11 \times 11 \times 11$ title, also the brainchild of Manny) to November 13. Since the teaching of Calculus affects the largest number of students of any Mathematics course in the province, and is one of the most widely taught undergraduate courses period, the importance of such a meeting to the teaching of Mathematics, both at the undergraduate and the school levels, is manifestly clear. The object of this talk will be to first outline what took place at the meeting, and then talk about the document being produced as an outcome of the meeting, The Alberta Calculus Protocol, and how it has the potential to influence and improve the teaching of Mathematics, and Calculus in particular, at all levels in the province. One of the objectives of this document is that it be an ongoing rather than a finalized document, to which all educators are welcome to contribute.
<b>Contributed Talk 5</b>	
Speaker	Roberta La Haye – <a href="mailto:rllahaye@mtroyal.ca">rllahaye@mtroyal.ca</a>
Institution	Department of Mathematics, Physics and Engineering, Mount Royal University
Title	Using Visual Arts to Motivate Mathematics at Various Education Levels
Abstract	There are some nice applications of mathematics to art at various education levels. I will discuss a few that are relevant to University level mathematics. I will also share my experience in working with students, artists and teachers in activities relating mathematics and art.
<b>Contributed Talk 6</b>	
Speaker	Peter Zizler – <a href="mailto:pzizler@mtroyal.ca">pzizler@mtroyal.ca</a>
Institution	Department of Mathematics, Physics and Engineering, Mount Royal University
Title	Calculus Applications: the absurd, the cute and the other
Abstract	We will present some thoughts on applications of introductory first year calculus material.





**General Session, suite  
Room 1-01 McMahon Pavilion**

<b>Contributed Talk 7</b>	
Speaker	Josey Hitesman – josey.hitesman@gmail.com
Institution	Math Kangaroo Edmonton
Title	Dispelling the Myth that Mathematics is Boring: Making Math Fun
Abstract	Math Kangaroo training activities at Concordia were developed as a direct response to the parents and participants' request for more practice opportunities. However, the scope and objectives expand beyond the purpose of the contest alone. The training component is becoming a network of math enrichment activities for diverse audiences, which contributes to de-demonizing and the promotion of math, science, and engineering.

<b>Contributed Talk 8</b>	
Speaker	Higher Education Pearson Canada
Institution	Higher Education Pearson Canada
Title	Pearson Canada - digital tools to enhance learning
Abstract	Pearson is Canada's pre-eminent publisher of learning materials for college and universities. Attend this session and see the new technologies Pearson has to offer you and how they can be used to enhance student engagement and learning in and out of the classroom. Products include Ponopto video software, Pearson e-Text for iPads, Smarthinking on demand student tutoring services and more!





## May 4<sup>th</sup>, 2012 - North South Dialogue in Mathematics

### Plenary Lectures Auditorium McMahon Pavilion

Plenary Lecture 1	
Speaker	Jean-Marie De Koninck – <a href="mailto:Jean-Marie.DeKoninck@mat.ulaval.ca">Jean-Marie.DeKoninck@mat.ulaval.ca</a>
Institution	Department of mathematics and statistics at Université Laval
Title	<b>The mysterious world of normal numbers</b>
Abstract	<p>Given an integer <math>q &gt; 1</math>, we say that a positive real number <math>x</math> is <math>q</math>-normal if every <math>k</math>-long string of digits in the base <math>q</math> expansion of <math>x</math> appears with the expected frequency, namely <math>1/q^k</math>. Amazingly, although one can show that almost all real numbers are normal (in the sense that the set of exceptions has Lebesgue measure zero), there is no general method that allows one to decide if a given real number is normal or not. We will first give a brief survey of the main results obtained so far on normal numbers. Then, we will show how we were able to use the complexity of the multiplicative structure of positive integers to construct large families of normal numbers.</p>
Plenary Lecture 2	
Speaker	Robert McCann – <a href="mailto:mccann@math.toronto.edu">mccann@math.toronto.edu</a>
Institution	Geometric Variational Problems in Economics
Title	<b>The Secret Life of Mathematics</b>
Abstract	<p>Geometry and economics have interacted very little over the last fifty years. They are likely to interact very substantially over the next fifty years. This talk will describe some surprising recent interactions between geometry and economics.</p> <p>The monopolist's problem, for example, consists of deciding what types of products to manufacture and how much to charge for each of them, knowing only statistical information about the preferences of an anonymous field of potential buyers. It is one of the basic problems analyzed in economic theory. The solution to this problem when the space of products and of buyers can each be parameterized by a single variable (say quality <math>X</math>, and income <math>Y</math>) garnered Mirrlees (1971) and Spence (1974) their Nobel prizes in 1996 and 2001.</p> <p>The multidimensional version of this question is a largely open problem in geometric analysis.</p> <p>I will describe recent work with A Figalli and Y-H Kim, identifying structural conditions on the value <math>b(X, Y)</math> of product <math>X</math> to buyer <math>Y</math> which reduce this problem to a convex program in a Banach space --- leading to uniqueness and stability results for its solution, confirming robustness of certain economic phenomena such as the desirability for the monopolist to raise prices enough to drive a positive fraction of buyers out of the market, and yielding conjectures about the robustness of other phenomena, such as the clumping together of products marketed into subsets of various dimension.</p> <p>The passage to several dimensions relies on ideas from differential geometry / general relativity, optimal transportation, and nonlinear partial differential equations.</p>



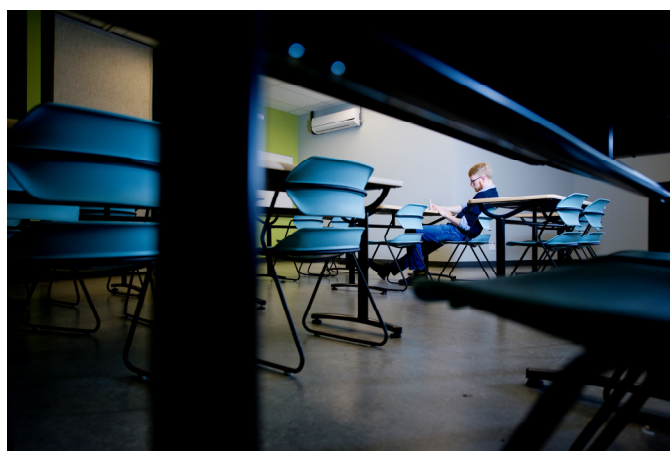


**Plenary Lectures, suite  
Auditorium McMahon Pavilion**

Plenary Lecture 3	
Speaker	Alexander Melnikov – <a href="mailto:melnikov@ualberta.ca">melnikov@ualberta.ca</a>
Institution	Department of Mathematical & Statistical Sciences, University of Alberta
Title	<i>On Quantitative Risk-Management in Equity-Linked Life Insurance</i>
Abstract	In the talk we study equity-linked life insurance contracts with fixed and stochastic guarantees linked to the evolution of a financial market. The presence of a client's mortality risk does not allow perfect hedging, and we utilize imperfect hedging methodologies. These methodologies were developed in mathematical finance based on loss function conceptions (quantile and efficient hedging) and risk measures. We allow an insurance company to be exposed to a financial risk. The price of the contracts will be subject to a maximization/minimization of the expected loss function/risk measure under initial budget constraints. In the Black-Scholes and jump-diffusion setting we derive equations separating financial and insurance risks embedded in the contracts and propose a methodology for effective risk-management of the contracts. Pooling homogeneous clients together enables the insurance company to take advantage of diversification of a mortality risk. A large enough portfolio of life insurance contracts will result in a more predictable mortality exposure and reduced prices. The results will be illustrated with the help of financial indices (S&P 500 and the Russell 2000).

**General Session  
Room 1-01 McMahon Pavilion**

Contributed Talk 1	
Speaker	Eric Roettger – <a href="mailto:eroettger@mtroyal.ca">eroettger@mtroyal.ca</a>
Institution	Department of Mathematics, Physics and Engineering, Mount Royal University
Title	Some New Results on Divisibility Sequences of Order 6
Abstract	The sequence $\{u_n\}$ is called a divisibility sequence if $u_m \mid u_n$ whenever $m \mid n$ and $u_m \neq 0$ . This talk will be a short discussion on some well-known divisibility sequences and some less well-known. A few new results will be given. Also a brief explanation as why anyone would care.





**General Session, suite  
Room 1-01 McMahon Pavilion**

Contributed Talk 2	
Speaker	Timur Akhunov – <a href="mailto:akhunov@gmail.com">akhunov@gmail.com</a>
Institution	Department of Mathematics and Statistics, University of Calgary
Title	On the Cauchy problem for the Airy type equations
Abstract	Dispersive equations historically emerged as basic models in the mathematical study of water waves starting with Laplace and Airy in the early 19th century. One of such equations is a linear third order Airy equation. A key feature of the Airy equation is dispersion, which heuristically is described by spatially localized waves moving to infinity with the speed of propagation dependent on the frequency of the wave. On the other hand, this dispersive effect is local and weakens at spatial infinity, where other effects may come into play. In this talk I will discuss a sharp condition on the coefficients of the equation for the wellposedness (existence, uniqueness, etc) of the Cauchy problem associated to some Airy type equations. Understanding of such Airy type equations is useful for non-linear problems that arise in water waves.

Contributed Talk 3	
Speaker	Brendan Pass – <a href="mailto:pass@ualberta.ca">pass@ualberta.ca</a>
Institution	Department of Mathematical & Statistical Sciences, University of Alberta
Title	Density functional theory and optimal transportation
Abstract	Density functional theory (DFT) is a modeling method used by physicists and chemists to understand electron correlations. Two recent papers by Cotar, Friesecke and Kluppelberg have revealed that optimal transportation methods can yield insights into DFT. In particular, they show that in the semi-classical limit, evaluating the Hohenberg-Kohn functional, (which returns the minimal energy of a system of interacting electrons, with a prescribed single particle density) amounts to solving a certain multi-marginal optimal transportation problem. In this talk, I will present an upper bound on the semi-classical Hohenberg-Kohn functional, derived from the optimal transportation formulation.





**General Session, suite  
Room 1-01 McMahon Pavilion**

Contributed Talk 4	
Speaker	Ami Viselter – <a href="mailto:viselter@ualberta.ca">viselter@ualberta.ca</a>
Institution	Department of Mathematical & Statistical Sciences, University of Alberta
Title	Locally compact quantum groups and amenability
Abstract	<p>The concept of group duality is one of the most fundamental ones in the analysis of abelian, locally compact groups.</p> <p>The theory of quantum groups was initially developed in order to provide a framework for duality of general locally compact groups.</p> <p>Building on the preceding, deep work of Kac and Vainerman, Enock and Schwartz, Woronowicz and Baaj and Skandalis (to name a few), Kustermans and Vaes suggested in 1999 a relatively simple set of axioms for "locally compact quantum groups" (LCQGs).</p> <p>In this talk we will introduce their definition, and discuss a few specific types of LCQGs. Afterwards, we will review the definition of amenability for locally compact groups, present its generalization(s) to LCQGs, and relate several problems of current research connected with these notions.</p>

Contributed Talk 5	
Speaker	Cristian Ivanescu – <a href="mailto:IvanescuC@macewan.ca">IvanescuC@macewan.ca</a>
Institution	Mathematics and Statistics, Grant MacEwan University and University of Alberta
Title	A Krein-Milman type theorem for $C^*$ -algebras
Abstract	<p>Positive unital maps between <math>C^*</math>-algebras form a convex set whose extreme points are unital homomorphisms. For a large class of homogeneous algebras, K. Thomsen showed that the closed convex hull of <math>*</math>-homomorphisms is the set of unital positive maps. Later L. Li showed a major improvement of Thomsen's result which proved to be essential to the classification program for <math>C^*</math>-algebras. In our work, we plan to extend these results to certain subhomogeneous <math>C^*</math>-algebras.</p>

Contributed Talk 6	
Speaker	Ashok Krishnamurthy – <a href="mailto:akrishnamurthy@mtroyal.ca">akrishnamurthy@mtroyal.ca</a>
Institution	Department of Mathematics, Physics and Engineering, Mount Royal University
Title	An Introduction to R Programming Language
Abstract	<p>R programming language a free tool commonly used by statisticians for data analysis and graphics. This talk will give an introduction to R programming language as well as the materials to learn how to use R in a Mathematical Statistics class setting. I will present simulation techniques with examples of differential equations and spatial data analysis.</p>



**Mathematical Finance**  
**Organizer : Alexander Melnikov**  
**Room 2-66 McMahon Pavilion**

Contributed Talk 1	
Speaker	Christoph Frei – <a href="mailto:cfrei@ualberta.ca">cfrei@ualberta.ca</a>
Institution	Department of Mathematical & Statistical Sciences, University of Alberta
Title	From classical utility maximization to financial markets with interacting investors
Abstract	We start by considering an agent who invests in a financial market such that the expected utility of her terminal wealth is maximized. This leads to an optimization problem which is classical in mathematical finance. Subsequently, we study what happens if the agent does not only consider her own wealth but compares it with the performance of her peers. In this more realistic setting, new phenomena can occur. For example, an agent may ruin another even unintentionally so that no equilibrium can exist. However, when all the agents are willing to waive little expected utility, an approximated equilibrium can be established. The results stem from new techniques in stochastic analysis and their interplay with mathematical finance. The talk is based on joint work with Gonçalo dos Reis (TU Berlin).
Contributed Talk 2	
Speaker	Kaijie Cui – <a href="mailto:kacui@ucalgary.ca">kacui@ucalgary.ca</a>
Institution	Department of Mathematics and Statistics, University of Calgary
Title	Weather derivatives with applications to Canadian data
Abstract	Modelling of Daily average temperature variations of Canadian Data by a mean-reverting Ornstein-Uhlenbeck process driven by general Levy Process is proposed. The process also contains seasonal mean and volatility and empirically proved that the proposed dynamics fit Calgary and Toronto temperature data successfully. The model is also applied to derive an explicit price of CAT futures, and numerical prices of CDD and HDD futures prices using fast Fourier transform.
Contributed Talk 3	
Speaker	Hao Li – <a href="mailto:deepblue.leon@gmail.com">deepblue.leon@gmail.com</a>
Institution	Department of Mathematical & Statistical Sciences, University of Alberta
Title	On polynomial extensions of stock return models
Abstract	It is a well-known observational result that the logarithmic financial returns are following non-normal distributions, with evidence in the fat-tail property, non-zero skewness, excess kurtosis and other observed indications. We use the Student's T-distribution to adjust the tail estimation for the logarithmic financial return, and use a product of the T-distribution density and orthogonal polynomials to fit the return distribution density, in order to adjust the estimation for skewness, kurtosis and other moment parameters. We call this new model as the Polynomial-T-Distribution model. We compare this new model and other related models including the Black-Scholes model, the Gram-Charlier model and the T-Distribution model, based on the historical data of S&P 500 index. Efficiency of these models is evaluated using likelihood function and Bayesian Information Criteria.



**Mathematical Finance, suite**  
**Organizer : Alexander Melnikov**  
**Room 2-66 McMahon Pavilion**

Contributed Talk 4	
Speaker	Ke Zhao – <a href="mailto:kzhao@ucalgary.ca">kzhao@ucalgary.ca</a>
Institution	Department of Mathematics and Statistics, University of Calgary
Title	Generalization of the Black-76 formula: Markov-modulated volatility
Abstract	In this presentation, we invoke the Markov-modulated volatility and apply it to generalize Black-76 formula. Black formulas for Markov-modulated markets with and without jumps are presented as well. Application is given using Nordpool weekly electricity forward prices.

Contributed Talk 5	
Speaker	Shuo Tong – <a href="mailto:stong2@ualberta.ca">stong2@ualberta.ca</a>
Institution	Department of Mathematical & Statistical Sciences, University of Alberta
Title	Quantile hedging for equity-linked life insurance contracts with stochastic interest rate
Abstract	<p>Equity-linked life insurance contracts are very popular insurance products in North America. Such contracts link the benefit payable at the maturity time with the market value of some reference portfolio. In this talk, I will discuss the problem of pricing equity-linked life insurance contracts and also the valuation of insurance contracts with stochastic guarantee. The contracts under consideration are based on two risky assets which satisfy a two-factor jump-diffusion model: one asset is responsible for future gains, and the other one is a stochastic guarantee.</p> <p>As most life insurance products are long-term contracts, it is more practical to consider the problem in a stochastic interest rate environment. In our setting, the stochastic interest rate behavior is also described by a jump-diffusion model. In addition, quantile hedging technique is developed and exploited to price such finance/insurance contracts with initial capital constraints.</p>

Contributed Talk 6	
Speaker	Babacar Seck – <a href="mailto:babacar@ucalgary.ca">babacar@ucalgary.ca</a>
Institution	University of Calgary
Title	Portfolio Optimization Subject to Market Risk Constraints
Abstract	<p>There are two approaches to take into account market risk in portfolio management: risk measures and utility functions.</p> <p>We show that these two approaches are equivalent. As an application, we quantify a loss aversion parameter associated with, a portfolio optimization problem subject to a Conditional Value-at-Risk constraint.</p>



**Students' Sessions**  
**Organizer : Patrice Rivard**  
**Room 1-64 McMahon Pavilion**

<b>Contributed Talk 1</b>	
Speaker	Richard M. Slevinsky – <a href="mailto:rms8@ualberta.ca">rms8@ualberta.ca</a>
Institution	Department of Mathematical & Statistical Sciences, University of Alberta
Title	Computing the cumulative generalized hyperbolic distribution
Abstract	<p>The Black-Scholes model for asset pricing in financial markets has an undeniable influence in mathematical finance. However, the assumption of heavy tails as in this normally distributed model implies extremely small probabilities for drastic events such as market crashes. This assumption has been found to be inconsistent with market data. The generalized hyperbolic model has found a use in the modeling of financial assets because it has semi-heavy tails, and multiple parameters which can vary the skewness, kurtosis, and overall shape of the probability density. The number and impact of these parameters makes any model based on it very flexible and versatile; however, computing the cumulative generalized hyperbolic distribution is very challenging. In this talk, I propose a general method to compute this challenging cumulative distribution for a wide range of parameters.</p> <p>This work is a collaboration between me, Dr. Hassan Safouhi of the University of Alberta's Campus Saint-Jean, and Dr. David Scott of the University of Auckland, NZ.</p>

<b>Contributed Talk 2</b>	
Speaker	William Davis – <a href="mailto:wdavis@ualberta.ca">wdavis@ualberta.ca</a>
Institution	Department of Mathematical & Statistical Sciences, University of Alberta
Title	Two models for Indirectly Transmitted Diseases : Cholera
Abstract	<p>Cholera is still a problem in many parts of the world causing hundreds of thousands of deaths annually. Despite being studied for more than 100 years, its dynamics are not fully understood.</p> <p>I will present an iSIR model (indirect SIR model) which incorporates a minimum infectious dose into the infection term, and an iSIBP model which includes the role of bacteriophage as a predator for the bacteria that cause cholera.</p>





**Students' Sessions, suite**  
**Organizer : Patrice Rivard**  
**Room 1-64 McMahon Pavilion**

<b>Contributed Talk 3</b>	
Speaker	Amanda Swan – <a href="mailto:acswan@ualberta.ca">acswan@ualberta.ca</a>
Institution	Department of Mathematical & Statistical Sciences, University of Alberta
Title	An investigation of Anisotropic Diffusion using the Apparent Diffusion Coefficient and the Mean Squared Displacement
Abstract	<p>Many biological processes can be modeled using diffusion. One such example is brain tumors, or gliomas. Unfortunately, a simple diffusion model is not effective in representing this spread. When these tumors spread, the diffusion occurs more quickly along the fibrous white matter tracks than through the surrounding grey matter. For this reason, a more sophisticated model of diffusion must be created in order to allow for varying diffusion coefficients (or equivalently, rates of diffusion) in different directions.</p> <p>This project will focus on creating a computational model which allows for varying rates of diffusion in different directions. The results from the computational model will then be compared to the theoretical results. This is done by comparing the mean squared displacements, the distributions, and the apparent diffusion coefficients.</p>
<b>Contributed Talk 4</b>	
Speaker	Maryam Khajeh Alijani
Institution	Department of Mathematical & Statistical Sciences, University of Alberta
Title	How light and nutrient availability regulate abundances of bacteria and algae in the epilimnion?
Abstract	<p>In planktonic ecosystems algae and bacteria exhibit complex interrelationships, as algae provide an important organic source, DOC (dissolved organic carbon), for bacterial growth while bacteria recycles limiting nutrients for algae in a loose commensalism. However, algae and bacteria can also compete for available nutrients if supplies of organic matter are sufficient to satisfy bacterial need. We start with a stoichiometrically explicit model of bacteria-algae interactions in which practical assumptions about algal light and nutrient utilization, algal exudation of dissolved organic carbon (DOC), and bacterial role in processing of organic matter and nutrient have been included. We wish to see how this model makes definite predictions about how the relative balance of algae and bacteria should change in response to varied nutrient and light availability seen in lakes and also in laboratory studies.</p>



**Students' Sessions**  
**Organizer : Patrice Rivard**  
**Room 1-64 McMahon Pavilion**

Contributed Talk 5	
Speaker	Peng Du – <a href="mailto:pdu@math.ualberta.ca">pdu@math.ualberta.ca</a>
Institution	Department of Mathematical & Statistical Sciences, University of Alberta
Title	Using a network model to simulate transmitting of TB in a nursing home
Abstract	Nosocomial transmission of Tuberculosis (TB) in long-term care facilities among older adults is an important public health problem. In long-term care facilities, older adults live in an enclosed space, sharing the same sources of food, water and air. This increases the probability of transmission of infectious agents such as TB. A paper written by Stead and Rock (1981) described a TB outbreak in a 240-bed (112-room) nursing home. In this talk, I would like to introduce a network model to mimic the situation of TB outbreak numerically in this nursing home. The model is individual based and stochastic. I will firstly talk about how to estimate parameters in the model by the data given by Stead & Rock; then run this model to predict the effects of various intervention strategies. This model can also be applied to simulate the transmission of other infectious disease.

Contributed Talk 6	
Speaker	Vlad Gheorghiu – <a href="mailto:vgheorgh@gmail.com">vgheorgh@gmail.com</a>
Institution	Department of Mathematics and Statistics, University of Calgary
Title	Quantum entanglement: properties and evolution
Abstract	Entanglement is a key ingredient in a quantum computer, allowing for quantum algorithms that perform exponentially faster than any classical counterpart, such as factoring large numbers. In this talk I will gently introduce the concept of entanglement as a notion of quantum correlations and discuss some of its properties. I will then show how to explicitly quantify the "decay" of entanglement due external noise during a physical process (aka decoherence). The talk is intended to be self-contained and no prior exposure to quantum mechanics is required.

