22 Jan (Tue)

**Professor Alexander CHERNY** (Moscow State University & Bloomberg)

"Combinging Factor Risks in Risk Measurement Schemes"

Joint work with Raphael Douady (RiskData) and Stanislav Molchanov (UNCC Charlotte)

Abstract: This paper is related to the measurement of the risk of a portfolio, the risk being driven by multiple factors. The problem under consideration is proper combining of the risks brought by individual factors, with a view of dependence between them. The practical importance of the problem stems from the fact that one can effectively estimate the joint law of a portfolio and each single factor but, due to the lack of data, cannot estimate the joint law of portfolio and all factors. We propose a methodology based on: the notion of factor risks independently introduced in the industry by the RiskData and in the literature by Cherny and Madan; selecting a minimal multifactor risk profile matching single-factor risk profiles. Within this approach we provide a solution in the model, where the distribution of risk factors is a Gaussian copula. The solution is computationally feasible as it is reduced to inverting a matrix of a reasonable dimension.

5 Feb (Tue) 1:10-2:25, 903 SSW

Dr. Emmanuel SCHERTZER (Courant, NYU)
"The Dynamical Web and the Brownian Net"

Abstract: The discrete web is an infinite collection of coalescing random paths. This model arises in various contexts, such as the voter model in statistical mechanics and drainage networks in hydrology. In this seminar, I will first introduce a natural dynamic on the discrete web and I will study the dynamics of the entire collection of paths. In particular, the path starting from the origin will be a ”dynamical random walk” with very surprising properties. Finally, I will construct the scaling limit of that object (the dynamical Brownian Motion), and I will show how this construction also provides a natural scaling limit for the Potts model in 1 dimension.

7 Feb (Thu), 14 Feb (Thu)

Professor Ioannis KARATZAS
Topic: SDE

12 Feb (Tue) 1:00-2:00pm, 303 Mudd

Professor Philip PROTTER (Cornell)

"Recent results on bubbles and when European call prices decrease with time"

Abstract: Recent developments in the theory of financial bubbles in incomplete markets allows for the possibility of the ”birth” of bubbles within the model. We take the approach that the market chooses the risk neutral measure, an idea first proposed by Derman, Dupire, and others. We then allow for the possibility of regime change, where the market moves from one risk neutral measure to another;
this allows for bubble birth. We show how unusual events can occur (at least in theory) in the presence of bubbles, such as the a decrease in European call prices as time grows, holding the strike price constant.

The talk is based on joint work with Jean Jacod, Robert Jarrow, Soumik Pal, and Kazuhiro Shimbo.

12 Feb (Tue) 2:45-3:50, 214 Mudd

Professor Jonathan MATTINGLY (Duke)

"Ergodicity, Energy Transfer, and Stochastic Partial Differential Equations"

13 Feb (Wed) 12:00n-1:00pm, 903 SSW

Mr. Tomoyuki ICHIBA

"Stochastic Portfolio Analysis under Financial Atlas Model”

Abstract: We discuss an abstract financial equity market where the ranks of market capitals have an important role. Under a couple of reasonable assumptions the market has some stability properties which are observed in the real market. We study this Atlas model with relation to the reflected Brownian motion in a polyhedral domain. Several portfolio strategies are also discussed.

19 Feb (Tue), 26 Feb (Tue)

Mr. Johannes RUF
Topic: stochastic optimal control, *Fleming and Soner*.

21 Feb (Thu) 1025 SSW

Professor Alexander SCHIED (Cornell)

”Optimal Execution of Large Portfolios”
Analysis of a control problem arising in optimal portfolio liquidation

4 Mar (Tue), 6 Mar (Thu)

Dr. Nikolaos ENGLEZOS

”BSPDEs and Some Applications in Stochastic Control, Asset Pricing and Mathematical Economics”

11 Mar (Tue) 622 Math

Dr. Robert NEEL

”Martingale Methods in Minimal Surfaces”

13 Mar (Thu)

Qinghua Li

”BSDEs: solutions with constraints; applications to finance”
Mini-Course on Stochastic Analysis via Rough Paths

Ordinary differential equations of form \( dy(t) = V(y) \cdot dx(t) \), where \( V = (V_1, \ldots, V_d) \) is a collection of vector fields and \( x \) a \( d \)-dimensional input signal, arise naturally in various parts of pure and applied mathematics. In essence, T. Lyons’ Rough Path Analysis is a collection of highly non-trivial estimates for such equations.

The construction of diffusion processes led K. Itô’s to take \( x(t) = B(t, \omega) \), a \( d \)-dimensional Brownian sample path (hence of unbounded variation), and subsequently to his martingale-based theory of stochastic differential equations. The resulting solution map, known as Itô-map, \( B(\cdot, \omega) \mapsto y(\cdot, \omega) \) is notorious for its lack of continuity and this is precisely the difficulty in proving key theorems in diffusion theory, such as sample path large deviations or support theorems for \( y(\cdot, \omega) \).

Rough path theory on the other hand explains how the ODE solution map \( x \in C^1 \mapsto y \in C^1 \) can be continuously extended to the closure in various rough path metrics so that \( x(t) = B(t, \omega) \) can be accommodated after all. There is a conceptual price to pay: \( x \) has to be replaced by a path with values in a (free nilpotent) Lie group. In the case of Brownian motion this amount to replace \( B \) by the Enhanced Brownian motion \( \mathbf{B} = (B, A) \) where \( A \) is Lévy’s stochastic area. The Itô map then factorizes to

\[
B(\cdot, \omega) \mapsto \mathbf{B}(\cdot, \omega) \mapsto y(\cdot, \omega)
\]

where \( B \mapsto \mathbf{B} \) is only measurable while the mapping \( \mathbf{B} \mapsto y \) is deterministic and continuous business. As a consequence, many properties of \( y(\cdot, \omega) \) reduce auto-
matically to properties of $B(\cdot, \omega)$.

After a reasonably self-contained working introduction to rough path theory, I shall center this mini-course around Enhanced Brownian motion and the resulting corollaries for stochastic differential equations. Topics which I intend to cover include:

- Large deviations for $B$ and Freidlin-Wentzell theory.
- Support description for $B$ and the Stroock-Varadhan support theorem.
- Regularity of $B \mapsto y$ beyond Malliavin and non-degeneracy of solutions to rough differential equations.

The lectures will be accessible to graduate students in probability. A preliminary account can be found here
http://www.statslab.cam.ac.uk/peter/Columbia2008/roughpaths.htm

26 Mar (Wed) 11:30-12:30, 507 Math

Professor Julien DUBEDAT (Chicago)

SPECIAL PROBABILITY SEMINAR: ”SLE Partition Functions”

Abstract: A prime motivation for the study of Schramm-Loewner Evolutions is their relation with scaling limits of critical discrete statistical mechanics models. Major information for these models is encoded in their partition functions. We discuss a continuous analogue of this, in particular in relation with SLE path properties and Gaussian formalism.
Mr. Libor POSPISIL

The presentation would cover two topics, both of them related to the drawdown of a stochastic process. Their abstracts are below.

(1) PORTFOLIO SENSITIVITY TO THE CHANGES IN THE MAXIMUM AND THE MAXIMUMDRAWDOWN

By Libor Pospisil, Jan Vécere

In this talk, we define new "Greeks" for financial derivatives: sensitivities to the running maximum and the running maximum drawdown of an underlying asset. We derive probabilistic representations of these sensitivities for two classes of financial contracts: forwards on the maximum drawdown and lookback options. These results allow us to interpret the delta-hedge of the contracts in a novel way.

(2) FORMULAS FOR STOPPED DIFFUSION PROCESSES WITH STOPPING TIMES BASED ON DRAWDOWNS AND DRAWUPS

By Libor Pospisil, Jan Vécere, and Olympia Hadjiliadis

This paper studies drawdown and drawup processes in a general diffusion model. The main result is a formula for the joint distribution of the running minimum and the running maximum of the process stopped at the time of the first drop of size \(a\). As a consequence, we obtain the probabilities that a drawdown of size \(a\) precedes a drawup of size \(b\) and vice versa. The results are applied to several examples of diffusion processes, such as drifted Brownian motion, Ornstein-Uhlenbeck process, and Cox-Ingersoll-Ross process.
7 Apr (Mon) 9:15-10:30am, 903 SSW

**Professor Marc YOR** (University of Paris & French Academy of Sciences)

**SPECIAL PROBABILITY SEMINAR:** ”The Riemann-Zeta Function and Random Matrix Theory”

10, 17 Apr (Thu) 1:00-2:30pm, 1025 SSW  
15, 22 Apr (Tue) 1:00-2:30pm, 1025 SSW  
24 Apr (Thu) 9:00-10:30pm, 1025 SSW

**Professor Michel EMERY** (University of Strasbourg)

**MINERV A FOUNDATION LECTURES, SPRING 2008:**  
”Five Lectures on Manifold-Valued Semimartingales”  
Lecture notes are available at [http://hal.archives-ouvertes.fr/hal-00145073/fr/](http://hal.archives-ouvertes.fr/hal-00145073/fr/)

17 Apr (Thu) 7:40-9:00pm, 207 Math

**Dr. E. Robert FERNHOLZ** (InTech)

**SPECIAL MATHEMATICAL FINANCE PRACTITIONERS’ SEMINAR:**  
”Modeling Equity Market Behavior”

Abstract: Stock markets are stochastic models that exhibit some of the properties of real stock markets. In these markets, the stock capitalizations are modeled
by Brownian motions with drift and variance processes that depend on the market weights or the ranks of the stocks. We assume that the stocks pay no dividends, and that there are no splits or mergers. We study a number of market properties, including long-term stability, the existence of arbitrage, and the distribution of capital.

The simplest market models, those that appear in classical finance, have constant drift and variance parameters. While these models can be useful for studying short-term phenomena, they are unstable over the long term, and, hence, unsuitable for long-term analysis. In fact, in a market of stocks with constant drift and variance parameters, after the passage of time virtually all the market capital will become concentrated into single stocks. For long-term stability, variable drift and variance processes are needed, and we consider abstract markets that are stabilized either by volatility or by the use of parameters that are based on rank.

Volatility-stabilized markets are abstract markets in which the variance of the stocks is greater for smaller stocks. This property holds for real stock markets, and we show that it results in a form of long-term stability. In some of these markets, the greater volatility of the smaller stocks can be exploited by portfolios that systematically overweight these stocks, and this creates an opportunity for arbitrage.

Markets of stocks with drift and variance parameters that depend on rank can also be stable over the long term. Roughly speaking, if the lower-ranked stocks drift upward faster than the larger stocks, then the market will be stable over the long term. We can create markets of this type that have stable capital distributions similar to the capital distributions of real stock markets, however, the dynamic behavior of these markets is likely to be quite complicated, and there are many open questions regarding them.
8 May (Thu) 1025 SSW

Professor Ioannis KARATZAS
”Optimal Arbitrage”.
<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Venue</th>
<th>Speaker</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 Jan</td>
<td></td>
<td></td>
<td>Prof. Cherny</td>
<td>Moscow S U &amp; Bloomberg</td>
</tr>
<tr>
<td>05 Feb</td>
<td></td>
<td>903 SSW</td>
<td>Dr. Schertzer</td>
<td>Courant, NYU</td>
</tr>
<tr>
<td>07 Feb</td>
<td></td>
<td></td>
<td>Prof. Karatzas</td>
<td>Columbia</td>
</tr>
<tr>
<td>12 Feb</td>
<td>1:00-2:00</td>
<td>303 Mudd</td>
<td>Prof. Protter</td>
<td>Cornell</td>
</tr>
<tr>
<td>12 Feb</td>
<td>2:45-3:50</td>
<td>214 Mudd</td>
<td>Prof. Mattingly</td>
<td>Duke</td>
</tr>
<tr>
<td>13 Feb</td>
<td>12:00-1:00</td>
<td>903 SSW</td>
<td>Mr. Ichiba</td>
<td>Columbia</td>
</tr>
<tr>
<td>14 Feb</td>
<td></td>
<td></td>
<td>Prof. Karatzas</td>
<td>Columbia</td>
</tr>
<tr>
<td>19 Feb</td>
<td></td>
<td></td>
<td>Mr. Ruf</td>
<td>Columbia</td>
</tr>
<tr>
<td>21 Feb</td>
<td></td>
<td>1025 SSW</td>
<td>Prof. Schied</td>
<td>Cornell</td>
</tr>
<tr>
<td>26 Feb</td>
<td></td>
<td></td>
<td>Mr. Ruf</td>
<td>Columbia</td>
</tr>
<tr>
<td>28 Feb</td>
<td></td>
<td></td>
<td>Dr. Englezos</td>
<td></td>
</tr>
<tr>
<td>04 Mar</td>
<td></td>
<td></td>
<td>Dr. Englezos</td>
<td></td>
</tr>
<tr>
<td>11 Mar</td>
<td></td>
<td>622 Math</td>
<td>Dr. Neel</td>
<td>Columbia</td>
</tr>
<tr>
<td>13 Mar</td>
<td></td>
<td></td>
<td>Qinghua Li</td>
<td>Columbia</td>
</tr>
</tbody>
</table>

Spring Break

(to be continued on next page)
<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Venue</th>
<th>Speaker</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 Mar</td>
<td></td>
<td></td>
<td>Prof. Friz</td>
<td>Cambridge</td>
</tr>
<tr>
<td>26 Mar</td>
<td>11:30-12:30</td>
<td>507 Math</td>
<td>Prof. Dubedat</td>
<td>Chicago</td>
</tr>
<tr>
<td>27 Mar</td>
<td></td>
<td>1025 SSW</td>
<td>Prof. Friz</td>
<td>Cambridge</td>
</tr>
<tr>
<td>01 Apr</td>
<td></td>
<td>1025 SSW</td>
<td>Prof. Friz</td>
<td>Cambridge</td>
</tr>
<tr>
<td>03 Apr</td>
<td></td>
<td>1025 SSW</td>
<td>Mr. Pospisil</td>
<td>Columbia</td>
</tr>
<tr>
<td>07 Apr</td>
<td>9:15-10:30</td>
<td>903 SSW</td>
<td>Prof. Yor</td>
<td>U Paris &amp; FAS</td>
</tr>
<tr>
<td>08 Apr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Apr</td>
<td>1:00-2:30</td>
<td>1025 SSW</td>
<td>Prof. Emery</td>
<td>Strasbourg</td>
</tr>
<tr>
<td>15 Apr</td>
<td>1:00-2:30</td>
<td>1025 SSW</td>
<td>Prof. Emery</td>
<td>Strasbourg</td>
</tr>
<tr>
<td>17 Apr</td>
<td>1:00-2:30</td>
<td>1025 SSW</td>
<td>Prof. Emery</td>
<td>Strasbourg</td>
</tr>
<tr>
<td>17 Apr</td>
<td>7:40-9:00pm</td>
<td>207 Math</td>
<td>Dr. Fernholz</td>
<td>InTech</td>
</tr>
<tr>
<td>22 Apr</td>
<td>1:00-2:30</td>
<td>1025 SSW</td>
<td>Prof. Emery</td>
<td>Strasbourg</td>
</tr>
<tr>
<td>24 Apr</td>
<td>9:00-10:30</td>
<td>1025 SSW</td>
<td>Prof. Emery</td>
<td>Strasbourg</td>
</tr>
<tr>
<td>24 Apr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29 Apr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01 May</td>
<td></td>
<td></td>
<td>David Fournie</td>
<td>Columbia</td>
</tr>
<tr>
<td>06 May</td>
<td></td>
<td></td>
<td>Georgios Fellouris</td>
<td></td>
</tr>
<tr>
<td>08 May</td>
<td></td>
<td>1025 SSW</td>
<td>Prof. Karatzas</td>
<td>Columbia</td>
</tr>
</tbody>
</table>