# 第八届全国概率论年会

# 会议手册

福建·福州

2023.08.20-08.24

# 目录

会议信息 . . . . . 1

会议指南 . . . . . 3

交通信息 . . . . . 5

会议日程 . . . . . 9

大会一小时特邀报告摘要 . . . . . 13

大会45分钟邀请报告摘要 . . . . . 15

大会分组报告摘要 . . . . . 19

# 会议信息

“第八届全国概率论年会”旨在更好地促进概率论及相关学科的发展，加强国内概率学者之间的学术交流与联系。年会内容主要包括概率论各研究方向最新成果及其在统计、金融、工程等相关领域的应用。年会定于 2023 年 8 月 20 日至 24 日在福州举行。本次会议由中国数学会概率统计分会主办，福建师范大学数学与统计学院承办。

**学术委员会(按姓氏拼音排序)：**

委员会主席：邵启满

委员会成员：陈大岳、巩馥洲、郭先平、李增沪、汤善健、王凤雨
吴　昊、吴　臻、张立新、张土生、张希承

**咨询委员会(按姓氏拼音排序)：**

委员会主席：马志明

委员会成员：陈木法、龚光鲁、郭懋正、侯振挺、林正炎、彭实戈
钱敏平、严加安、杨向群、郑伟安

**地方委员会：**

委员会主席：林火南

委员会成员：王　健、梁克龙、陈　密、陈晓平、黄璐静、方榕娟
顾玲琪、韩　伟、陈舒凯、吴炳耀

# 会议指南

★ 会议安排：

- 报到时间：2023 年 8 月 20 日 (周日) 12:00–22:00
- 报到地点：福州中庚喜来登酒店
- 邀请报告地点：喜来登酒店二楼宴会厅
- 分组报告地点：喜来登酒店一楼多功能厅 1–5
- 住宿地点 I： 福州中庚喜来登酒店

  住宿地点 II：福州中庚聚龙酒店
- 用餐地点 I： 福州中庚喜来登酒店盛宴西餐厅

  用餐地点 II：福州中庚聚龙酒店G层香汇自助餐厅

★ 会议联系人：黄璐静 15600692330

方榕娟 18810060956

# 交通信息

会议期间入住**福州中庚喜来登酒店、中庚聚龙酒店**，两家酒店相邻。

地址：福建省福州市仓山区南江滨西大道203号。

**乘车路线**

**1．福州火车站至福州中庚聚龙酒店**


【图中起点为福州火车站，终点为福州中庚聚龙酒店】

I：乘坐出租车。

II：地铁路线→从南广场出站，步行212米至“福州火车站”（A2口

进），乘坐地铁1号线（三江口方向），至“葫芦阵”地铁站（B口出）下车，乘坐出租车或步行155米至“地铁葫芦阵站”公交车站，乘坐353路公交车（海峡国际会展中心东站方向），在“中庚喜来登酒店站”公交车站下车，步行398米到达中庚聚龙酒店。

III：公交路线→从北广场出站，步行191米至“火车站北广场”公交车站，乘坐K2路公交车（火车南站方向），在“地铁葫芦阵站”公交车站下车，同站换乘353路公交车（海峡国际会展中心东站方向），在“中庚喜来登酒店站”公交车站下车，步行398米到达中庚聚龙酒店。

**2. 福州南站（火车站）至福州中庚聚龙酒店**

【图中起点为福州南站（火车站），终点为福州中庚聚龙酒店】

I：乘坐出租车。

II：地铁路线→步行140米至“福州火车南站”地铁站（C北口进），乘坐地铁1号线（象峰方向），在“葫芦阵”地铁站（B西北口出）下车，乘坐出租车或步行155米至“地铁葫芦阵站”公交车站，乘坐353路公交车（海峡国际会展中心东站方向），在“中庚喜来登酒店站”公交车站下车，步行398米到达中庚聚龙酒店。

**3．福州长乐国际机场至福州中庚聚龙酒店**


【图中起点为福州长乐国际机场，终点为福州中庚聚龙酒店】

I：乘坐出租车。

II：公交路线→步行183米至“空港快线长乐机场站”，乘坐空港快线阿弥陀佛大饭店专线，在“火车南站”下车，步行215米至“福州火车

南站”地铁站（D1 西北口进），乘坐地铁1号线（象峰方向），在“葫芦阵”地铁站（B西北口出）下车，乘坐出租车或步行155米至“地铁葫芦阵站”公交车站，乘坐353路公交车（海峡国际会展中心东站方向），在“中庚喜来登酒店站”公交车站下车，步行398米到达中庚聚龙酒店。

# 会议日程

**2023 年 8 月 21 日 (周一)**

| 报告厅 | 喜来登酒店二楼宴会厅 | | | | |
|---|---|---|---|---|---|
| 8:30-9:00 | 开幕致辞+合影 | | | | |
| 9:00-10:00 | 大会一小时特邀报告：陈增敬　　主持人：陈大岳 | | | | |
| 10:00-10:20 | 茶歇 | | | | |
| 10:20-11:05 | 大会45分钟邀请报告：许惟钧　　主持人：李增沪 | | | | |
| 11:05-11:50 | 大会45分钟邀请报告：朱湘禅　　主持人：李增沪 | | | | |
| 11:50-14:00 | 午餐 | | | | |
| 一楼多功能厅 | 厅-1 | 厅-2 | 厅-3 | 厅-4 | 厅-5 |
| 主持人 | IS01 陈大岳 | IS02 刘伟(武汉大学) | IS03 王光臣 | IS04 林一青 | IS05 朱蓉禅 |
| 14:00-14:30 | 姚强 | 让光林 | 孟庆欣 | 张静 | 罗德军 |
| 14:30-15:00 | 赵林杰 | 李宋子 | 倪元华 | 殷礼鸣 | 张登 |
| 15:00-15:30 | 马瑞博 | 邓昌松 | 王天啸 | 顾子昊 | 周国立 |
| 15:30-16:00 | 薛晓峰 | 成灵妍 | 聂天洋 | 徐坤 | 孙振尧 |
| 16:00-16:20 | 茶歇 | | | | |
| 一楼多功能厅 | 厅-1 | 厅-2 | 厅-3 | 厅-4 | 厅-5 |
| 主持人 | IS06 朱全新 | IS07 刘伟(武汉大学) | IS08 汤善健 | IS09 彭君 | IS10 毛永华 |
| 16:20-16:50 | 朱全新 | 李应求 | 周建军 | 鲁大伟 | 刘源远 |
| 16:50-17:20 | 袁海燕 | 韩邦先 | 吴锦标 | 周杰明 | 蔡卓轩 |
| 17:20-17:50 | 王豹 | 钱斌 | 梁嘉豪 | 段军霞 | 黄璐静 |
| 17:50-18:20 | 张萌 | 丁昊 | 汤善健 | 彭君 | 王涛 |
| 18:20-20:00 | 晚餐 | | | | |

**2023 年 8 月 22 日 (周二)**

| 报告厅 | 喜来登酒店二楼宴会厅 | | | | |
|---|---|---|---|---|---|
| 8:40-9:40 | 大会一小时特邀报告：刘卫东　　主持人：吴　臻 | | | | |
| 9:40-10:00 | 茶歇 | | | | |
| 10:00-10:45 | 大会45分钟邀请报告：邵井海　　主持人：张希承 | | | | |
| 10:45-11:30 | 大会45分钟邀请报告：陈昕昕　　主持人：张希承 | | | | |
| 11:30-14:00 | 午餐 | | | | |
| 一楼多功能厅 | 厅-1 | 厅-2 | 厅-3 | 厅-4 | 厅-5 |
| 主持人 | IS11 李曾 | IS12 巫静 | IS13 李增沪 | IS14 罗德军 | IS15 王恒放 |
| 14:00-14:30 | 方笑 | 张华 | 高志强 | 赵国焕 | 章晓菲 |
| 14:30-15:00 | 范协铨 | 余显烨 | 蒲飞 | 邱召阳 | 毛晓军 |
| 15:00-15:30 | 胡治水 | 陈方 | 石权 | 刘子愉 | 王恒放 |
| 15:30-16:00 | 李曾 | 王首天 | 杨叙 | 郭书晨 | 王中雷 |
| 16:00-16:20 | 茶歇 | | | | |
| 一楼多功能厅 | 厅-1 | 厅-2 | 厅-3 | 厅-4 | 厅-5 |
| 主持人 | IS16 王艳清 | IS17 申广君 | IS18 张立新 | IS19 吴昊 | IS20 郭先平 |
| 16:20-16:50 | 李宇勐 | 江一鸣 | 刘全升 | 黄逸超 | 黄永辉 |
| 16:50-17:20 | 杨青山 | 蒋辉 | 何辉 | 姜建平 | 张文钊 |
| 17:20-17:50 | 宋延红 | 刘俊峰 | 王汉超 | 顾陈琳 | 张振中 |
| 17:50-18:20 | 周友洲 | 王冉 | 张卓松 | 李欣意 | 董海玲 |
| 18:20-20:00 | 晚餐 | | | | |

**2023 年 8 月 23 日 (周三)**

| 报告厅 | 喜来登酒店二楼宴会厅 | | | |
|---|---|---|---|---|
| 8:40-9:40 | 大会一小时特邀报告：王凤雨　　主持人：汤善健 | | | |
| 9:40-10:00 | 茶歇 | | | |
| 10:00-10:45 | 大会45分钟邀请报告：苏中根　　主持人：张土生 | | | |
| 10:45-11:30 | 大会45分钟邀请报告：邱彦奇　　主持人：张土生 | | | |
| 11:30-14:00 | 午餐 | | | |
| 一楼多功能厅 | 厅-1 | 厅-2 | 厅-3 | 厅-4 |
| 主持人 | IS21 王凤雨 | IS22 杨帆 | IS23 翟建梁 | IS24 杨叙 |
| 14:00-14:30 | 徐礼虎&李想 | 姚东 | 王炜 | 金鹏 |
| 14:30-15:00 | 吕广迎 | 鲍志刚 | 尚世界 | 季丽娜 |
| 15:00-15:30 | 黄兴 | 何煜坤 | 刘伟(武汉大学) | 李培森 |
| 15:30-16:00 | 宋玉林 | 许媛媛 | 彭旭辉 | 马春华 |
| 16:00-16:20 | 茶歇 | | | |
| 一楼多功能厅 | 厅-1 | 厅-2 | 厅-3 | 厅-4 |
| 主持人 | IS25 刘红 | IS26 周帆 | IS27 孙晓斌 | IS28 史敬涛 |
| 16:20-16:50 | 周德清 | 史成春 | 陈娴 | 张峰 |
| 16:50-17:20 | 李志华 | 焦雨领 | 洪伟 | 孟维君 |
| 17:20-17:50 | 邱吉秀 | 苏敬勇 | 孙晓斌 | 王寒霄 |
| 17:50-18:20 | 李继泽 | 崔逸凡 | 周清 | 刘国民 |
| 18:20-20:00 | 晚餐 | | | |

**2023 年 8 月 24 日 (周四)**

| 报告厅 | 喜来登酒店二楼宴会厅 | |
|---|---|---|
| 8:40-9:40 | 大会一小时特邀报告：孙　鑫 | 主持人：张立新 |
| 9:40-10:00 | 茶歇 | |
| 10:00-10:45 | 大会45分钟特邀报告：陈　昕 | 主持人：郭先平 |
| 10:45-11:30 | 大会45分钟特邀报告：解龙杰 | 主持人：郭先平 |
| 11:30-14:00 | 午餐 | |
| | 自由讨论 | |

# 大会一小时特邀报告摘要

## PT01: 有关非线性中心极限定理的新研究

**Zengjing Chen, 陈增敬**
山东大学数学学院

**Abstract**: 自从 De Moivre (1733)、Gauss (1809) 和 Laplace (1810) 最早发现正态分布以来，中心极限定理作为概率统计中的“核心”定理得到广泛的应用和推广，因此，正态分布在概率统计享有着“中心”地位。一大批数学家在独立(弱独立)同分布 (IID) 的条件下得到了正态分布存在的普世性。然而, 经济界的三大经济悖论: 诺奖得主 Allias 提出 Allias 悖论 (1953)、经济学家 Ellsberg 提出的著名 Ellsberg 悖论 (1961) 和诺奖得主 Prescott 发现的股票溢价之谜 (1985) 显示了经济界的很多现象不符合 IID 的假设。在这次报告中，我们主要介绍我们在非 IID 条件下的非线性极限定理：1) 在非线性概率测度下，发现并证明了两类非线性正态分布的表达式。2) 在量子三态条件下得到了量子中心极限定理。3) 作为应用，我们发现: 多臂老虎机(多臂机器人)和机器强化学习服从这种非线性正态分布。我们的研究结果也显示了在量子世界和强化学习等领域，经典的正态分布不再占有“中心”地位了。

## PT02: Robust Policy Evaluation in Reinforcement Learning

**Weidong Liu, 刘卫东**
上海交通大学自然科学研究院

**Abstract**: In this paper, we propose a robust policy evaluation algorithm in reinforcement learning, to feature outlier contamination and heavy-tailed reward distributions. We further develop a fully-online method to conduct statistical inference. Our method converges faster to the minimum asymptotic variance than the classical temporal difference (TD) learning and avoids the selection of the step sizes. Numerical experiments are provided on the effectiveness of the proposed algorithm in real-world reinforcement learning experiments.

## PT03: 非对称从属扩散过程经验分布的 Wasserstein 极限

**Feng-Yu Wang, 王凤雨**
天津大学应用数学中心

**Abstract**: 在一个一般框架下，研究非对称从属扩散过程经验分布在 Wasserstein 距离下的极限，获得精确收敛速度，刻画了非对称扰动对收敛的加速效应。所获结果被应用于流形上反射扩散过程，条件扩散过程，Wright Fisher 过程，和次 Riemann 流形上的亚椭圆扩散过程。

## PT04: 二维共形场论与随机几何

**Xin Sun, 孙鑫**
宾夕法尼亚大学数学学院

**Abstract**: 共形场论源于上世纪八十年代对弦论和统计物理的研究，对诸多数学分支产生了深远影响。本报告通过介绍几个定理和猜想，展示共形场论的思想在随机几何，特别是刘维尔量子引力和二维格点模型中的应用。

# 大会45分钟邀请报告摘要

## PT05: 奇异随机偏微分方程与匀质化

**Weijun Xu, 许惟钧**
北京国际数学研究中心

**Abstract**: 我们考虑一类带高度震荡 (周期) 系数算子的奇异随机偏微分方程问题。这类问题结合了重整化与匀质化这两类奇异性的极限过程。我们的初衷是理解它们在同一个问题中的交互影响。我将汇报一下我们在这个方面的一些工作。报告基于与陈弈霖和 Benjamin Fehrman 的合作。

## PT06: Kolmogorov $4/5$ law for the forced Navier-Stokes equation and anomalous dissipation by solution of randomly forced Navier-Stokes equations

**Xiangchan Zhu, 朱湘禅**
中国科学院数学与系统科学研究院

**Abstract**: In this talk I will talk about two results. First, we identify a sufficient condition under which solutions to the 3D forced Navier-Stokes equations satisfy an Lp in time version of the Kolmogorov 4/5 law for the behavior of the averaged third order longitudinal structure function along the vanishing viscosity limit. The sufficient condition is satisfied e.g. by the solutions constructed by Bruce, Colombo, Crippa, De Lellis, and Sorella in [BCCDLS22].In this particular case, our results can be applied to derive a bound for the exponent of the third order absolute structure function in accordance with the Kolmogorov turbulence theory. Second, we show the existence of a velocity field v, solution of (randomly) forced Navier-Stokes equations, which produces total dissipation of kinetic energy in finite time when advecting a passive scalar. The total dissipation holds true uniformly in the viscosity parameter and the initial conditions, in particular the dissipation is anomalous.

## PT07: Optimal control problem for McKean-Vlasov equations and its associated HJB equations on Wasserstein space

**Jinghai Shao, 邵井海**
天津大学应用数学中心

**Abstract**: This talk concerns the optimal control problem for McKean-Vlasov equations. We study the existence of optimal controls, and establish the dynamic programming principle. To characterize the value function, certain HJB equations on Wasserstein space are established. Then the existence and uniqueness of the viscosity solution is studied.

## PT08: Fixed points and the corresponding domain of attraction for branching Brownian motion on $\mathbb{R}$

**Xinxin Chen, 陈昕昕**
北京师范大学数学科学学院

**Abstract**: Liggett [1] considered Markov chains (like Brownian motion) started from a point process and obtained the fixed points/invariant measures. We consider one-dimensional branching Brownian motion (BBM) started from a point process. We introduce a suitable metric space of locally finite point measures on which we

- prove that BBM with critical drift is a well-defined Markov process which satisfies Feller property;
- characterize all invariant measures/fixed points for BBM with critical drift;
- characterize all invariant measures/fixed points for Brownian motion by our new method;
- characterize the domain of attraction of each fixed point.

This is based on our joint works with Christophe Garban (University of Lyon 1, France) and Atul Shekhar (Tata Institute of Fundamental Research-CAM, India).

### References

[1] Thomas M. Liggett (1978). Random invariant measures for Markov chains, and independent particle systems, *Zeitschrift für Wahrscheinlichkeitstheorie und Verwandte Gebiete*, **45(4)**, 297-313.

## PT09: Euler-Maruyama's approximations of regime-switching diffusion processes

**Zhonggen Su, 苏中根**
浙江大学数学科学学院

**Abstract**: There have been a lot of research activities around regime-switching diffusion processes in the past decade. In this talk we mainly focus on the issue of Euler-Maruyama's approximations of regime-switching diffusion processes. In particular, consider a kind of state-independent regime-switching jump diffusion process $(X_t, Z_t)_{t\geq 0}$ and use the Euler-Maruyama (EM) scheme with constant step $\gamma$ and decreasing step sequence $(\gamma_n)_{n\geq 1}$, respectively. Let $\mu$, $\mu_\gamma$ and $\mu_{\gamma_n}$ denote respectively the corresponding invariant measures of diffusion process and its discretization processes. Under some regular conditions we use the Stein method to show that the error between $\mu$ and $\mu_\gamma$ is bounded by $O(\gamma^{1/2})$, and invoke the method recently developed in Pagès and Panloup to show the error between $\mu$ and $\mu_{\gamma_n}$ is bounded by $O(\gamma_n^{1/2})$. An analog is studied for the state-dependent regime-switching (without jump) diffusion model as well. This talk is based on recent joint works together with Chen, Jin and Shen.

## PT10: Some old and new aspects on tree-indexed stochastic processes

**Yanqi Qiu, 邱彦奇**
武汉大学数学与统计学院

**Abstract**: We will talk about some new aspects on tree-indexed stochastic processes: 1) maximum of certain Gaussian processes on trees; 2) Moment estimates of Mandelbrot Cascades; 3) Spectral measures of branching-type stationary stochastic processes on trees. The talk is based on joint works with Yong Han and Zipeng Wang.

## PT11: Some recent results on stochastic homogenization for stable-like process

**Xin Chen, 陈昕**
上海交通大学数学科学学院

**Abstract**: In this talk we will introduce some recent results on stochastic homogenization for stable-like process, including stochastic homogenization for stable-like process with possibly degenerate jumping kernel, the quantification of stochastic homogenization for stable-like random walk in random conductance model, the quantification of stochastic homogenization for the Dirichlet problem associated with stable-like process in periodic environment. This talk is based on some joint works with Zhen-Qing Chen,Takashi Kumagai and Jian Wang.

## PT12: Asymptotic behavior for fully coupled multi-scale non-linear stochastic systems

**Longjie Xie, 解龙杰**
江苏师范大学数学与统计学院

**Abstract**: We develop a new argument to study the asymptotic bahavior of the multi-scale non-linear stochastic system involving the distribution of both the slow process and the fast motion. Explicit characterization of the limits are obtained not only for the slow process but also for the fast motion, which turn out to be quite un-expected in comparsion with the classical linear stochastic system. Moreover, optimal rates of convergence are also obtained.

# 大会分组报告摘要

Invited Session 01: 交互作用粒子系统的极限性质 组织者 陈大岳

Invited Session 02: 随机分析及其应用 组织者 刘 伟

Invited Session 03: Stochastic Control and Related Fields 组织者 吴 臻

Invited Session 04: 随机微分方程与梯度估计 组织者 林一青

Invited Session 05: 随机偏微分方程 组织者 朱蓉禅

Invited Session 06: 复杂随机非线性系统的稳定与控制 组织者 朱全新

Invited Session 07: 随机分析与最优传输问题 组织者 李向东

Invited Session 08: 随机系统的分析与控制 组织者 汤善健

Invited Session 09: 马氏过程与微分方程 组织者 彭 君

Invited Session 10: 马氏过程稳定性及应用 组织者 毛永华

Invited Session 11: 概率渐近理论 组织者 邵启满

Invited Session 12: 随机分析及马氏决策相关问题 组织者 巫 静

Invited Session 13: 分枝过程及相关课题 组织者 李增沪

Invited Session 14: 随机偏微分方程 组织者 罗德军

Invited Session 15: Complex big data analysis in modern statistics 组织者 王恒放

Invited Session 16: 相依过程的极限不等式与相关极限定理 组织者 王艳清

Invited Session 17: 分数布朗运动驱动的随机系统的分析 组织者 申广君

Invited Session 18: 极限理论 组织者 张立新

Invited Session 19: 统计物理模型与共形场论 组织者 吴 昊

Invited Session 20: 马氏过程与随机优化 组织者 郭先平

Invited Session 21: 分布依赖随机微分方程 组织者 王凤雨

Invited Session 22: 随机矩阵理论与应用 组织者 杨 帆

Invited Session 23: 随机偏微分方程 组织者 张土生

Invited Session 24: 连续状态分枝过程及相关模型 组织者 杨 叙

Invited Session 25: 随机过程与随机分析在非对称信息市场中的应用 组织者 刘 红

Invited Session 26: Recent advances of probability and statistics for machine learning 组织者 周 帆

Invited Session 27: 随机分析及其应用 组织者 孙晓斌

Invited Session 28: 延迟随机系统控制与积分方程 组织者 史敬涛

# IS 01: 交互作用粒子系统的极限性质

## Deviations for weak record numbers in some one–dimensional random walks

**Qiang Yao, 姚强**
*East China Normal University*

**Abstract**: Record numbers are important statistics in random walk models. In this talk, I will present the asymptotic probabilities of large and moderate deviations for the number of "weak records" (or "ladder points") in some kinds of one–dimensional random walks (including both nearest and non–nearest neighbor cases). The proofs depend only on the direct analysis of random walks. It will be especially illustrated that the traditional method of analyzing the local time of Brownian motions, which is often adopted for the nearest neighbor random walks, would lead to wrong conjectures for some non–nearest neighbor cases. (Joint work with Yuqiang Li.)

## Stationary fluctuations from hydrodynamic limits for interacting particle systems with several conservation laws

**Linjie Zhao, 赵林杰**
*Huazhong University of Science and Technology*

**Abstract**: The theory of hydrodynamic limits concerns about the macroscopic behavior of interacting particle systems, which is usually described by PDEs. To this end, one needs to prove law of large numbers for the empirical measure of the process. In this talk, we focus on stationary fluctuations from hydrodynamic limits. For particle systems with only one conservation law, it has been known that the stationary fluctuations exhibit a phase transition from Edwards-Wilkinson (EW) universality class to Kardar-Parisi-Zhang (KPZ) universality depending on the strength of weak asymmetry of the system. When the systems have several conservation laws, the mode coupling theory developed around 2014 and 2015 predicts new universality class, more precisely, the Lévy universality class. The aim of the talk is to give a brief introduction to the latter.

## The contact process and the voter model in a random environment: A few examples

**Ruibo Ma, 马瑞博**
*Beijing Jiaotong University*

**Abstract**: Some interacting particle systems that have been studied can be understood as the contact process or the voter model in a random environment. Plenty of research methods have been applied to this type of models. A few examples will be presented in this talk and briefly analysed. Open problems arising from a recent example (Ma, 2022) will be discussed.

## Large and moderate deviations for empirical density fields of stochastic SEIR epidemics with vertex-dependent transition rates

**Xiaofeng Xue, 薛晓峰**
*Beijing Jiaotong University*

**Abstract**: In this talk, we are concerned with stochastic susceptible-exposed-infected-removed epidemics on complete graphs with vertex-dependent transition rates. Large and moderate

deviations of empirical density fields of our models are given. Proofs of our main results follow from exponential martingale strategies introduced in Kipnis, Olla and Varadhan (1989) and Gao and Quastel (2003). New mathematical difficulties are mainly in checks of exponential tightness of fluctuation density fields of our processes. This talk is based on joint work with Yin Xueting.

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## IS 02: 随机分析及其应用

### Scaling limit of DPRM with correlated environment

**Guanglin Rang, 让光林**
*Wuhan University*

**Abstract**: In this talk，we will give a brief introduction on the progress of scaling limit of directed polymer of random walk in a correlated random environment. When the environment has long range correlation, especially, time correlation ocurs, we need to deal with the heavy calculation and some new idea is involved.

### The limiting behavior of the free path length of the periodic Lorentz gas in the Boltzmann-Grad limit

**Songzi Li, 李宋子**
*Renmin University of China*

**Abstract**:In this talk, we study the limiting behavior of the free path length of the periodic Lorentz gas in the Boltzmann-Grad limit. We present the asymptotic formula of its tail distribution, and also the central limit theorem with respect to the Boltzmann-Grad limit. The key ingredient in our results is the relation between the distribution of free path length in the Boltzmann-Grad limit and the dynamics of non-quasi unipotent flow on the lattice space.

### Euler-Maruyama scheme for SDEs driven by stable processes

**Changsong Deng, 邓昌松**
*Wuhan University*

**Abstract**: We develop an Euler-Maruyama scheme to approximate the invariant measures of SDEs driven by $\alpha$-stable processes. An explicit convergence rate is presented for the Wasserstein-1 distance, and we show that this rate is optimal for the Ornstein-Uhlenbeck process. Based on a joint work (Stoch. Process. Appl. 2023) with Peng Chen, Rene Schilling and Lihu Xu.

### Large deviations and moderate deviations for the multivalued McKean-Vlasov SDEs with jumps

**Linyan Cheng, 成灵妍**
*Nanjing University of Science & Technology*

**Abstract**: In this talk, we present sufficient conditions and criteria to establish a large deviation principle and a moderate deviation principle for the multi-valued McKean-Vlasov SDEs with jumps by means of the weak convergence approach.

# IS 03: Stochastic Control and Related Fields

## Stochastic Hamilton-Jacobi-Bellman Equations with Jumps

**Qingxin Meng, 孟庆欣**
*Huzhou University*

**Abstract**: This paper is mainly concerned with a stochastic HJB equation with Poisson jumps which is a fully nonlinear backward stochastic partial differential equation. It is motivated by a stochastic optimal problem where the controlled systems are driven by Brownian motion and Poisson jumps with random coefficients. Firstly we establish the dynamic programming principle for the corresponding stochastic optimal control problem to derive the general form of stochastic HJB equation with jumps. Secondly, we establish an verification theory which can construct an optimal pair for the optimal control problem. At last, we prove the existence and uniqueness result for some special form of stochastic HJB equation with jumps in the sense of Sobolev space. To this end, the most important step is that we must first establish the existence and uniqueness result fora class of backward stochastic evolution equations with jumps in Hilbert spaces. Then we recast the stochastic HJB equation with jumps as the backward stochastic evolution equation with jumps in Hilbert spaces to the existence and uniqueness results.

## Solving Coupled Nonlinear FBSDEs: the BML Method

**Yuanhua Ni, 倪元华**
*Nankai University*

**Abstract**: This report presents a numerical solution method based on optimizing the backward measurability loss (BML) for general coupled nonlinear FBSDEs. The theoretical properties are analyzed in terms of Picard iterations, and it is shown that the proposed loss is equivalent to solving an immobile equation. In contrast to the Deep BSDE method, the proposed method focuses more on optimising the error between the current solution and the true solution over the entire time interval, rather than just on reducing the error at the termination moment. The feasibility of the proposed method is verified by applying iterative strategies for solving dynamic programming equations and the extreme value principle for solving optimal control.

## Spike variations for stochastic Volterra integral systems

**Tianxiao Wang, 王天啸**
*Sichuan University*

**Abstract**: Spike variation technique plays a crucial role in deriving Pontryagin's type maximum principle of optimal controls for ordinary differential equations (ODEs), partial differential equations (PDEs), stochastic differential equations (SDEs), and (deterministic forward) Volterra integral equations (FVIEs), when the control domains are not assumed to be convex. In this talk, we properly extend this technique to the case of (forward) stochastic Volterra integral equations (FSVIEs), and obtain a new kind of second-order adjoint system, from which the maximum principle is derived naturally. Joint work with Prof. Jiongmin Yong (UCF).

## Discrete-time mean-field type stochastic optimal control problem and its application

**Tianyang Nie, 聂天洋**
*Shandong University*

**Abstract**: In this talk, a discrete-time mean-field type stochastic optimal control problem is studied. The goal is to derive the stochastic maximum principle with convex control domains. L-derivative is applied to handle the mean-field term and a technique of adjoint operator is used to overcome the difficulties of obtaining adjoint equations and duality relation. Then, the stochastic maximum principle for discrete-time mean-field type stochastic optimal control problem is established. Finally, as an illustration of our stochastic maximum principle, a discrete-time mean-variance portfolio selection problem is solved with the decoupling technique which is different from the continuous-time case. This talk is based on the joint work with Bozhang Dong and Prof. Zhen Wu.

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# IS 04: 随机微分方程与梯度估计

## A probabilistic approach to Neumann problems for elliptic PDEs with nonlinear divergence terms

**Jing Zhang, 张静**
*Fudan University*

**Abstract**: By a probabilistic method, we prove the existence and uniqueness of weak solutions to Neumann problems for a class of semi-linear elliptic partial differential equations with nonlinear singular divergence terms, which can only be understood in distributional sense. This leads to the further study on a new class of infinite horizon backward stochastic differential equations, which involves integrals with respect to a forward-backward martingale and a singular continuous increasing process.

## Extremal functions of Log-Sobolev functionals on non-smooth metric measure spaces

**Liming Yin, 殷礼鸣**
*University of Science and Technology of China / Shanghai Jiao Tong University*

**Abstract**: In this talk, we discuss the extremal functions of the log-Sobolev functional on compact metric measure spaces satisfying the $RCD^*(K;N)$ condition for K in R and N in $(2,\infty)$. We show the existence, regularity and positivity of non-negative extremal functions. Based on these results, we show a Li-Yau type estimate for the logarithmic transform of any non-negative extremal functions of the log-Sobolev functional. As applications, we prove a Harnack type inequality as well as lower and upper bounds for the non-negative extremal functions. These results generalize several classical results proved on Riemannian manifolds due to Rothaus and Wang to the non-smooth setting of finite-dimensional compact RCD spaces.

## Quadratic BSDEs with mean reflection driven by $G$-Brownian motion

**Zihao Gu, 顾子昊**
*Shanghai Jiao Tong University*

**Abstract**: In this talk, we present the well-posedness of a kind of backward stochastic differential equation driven by $G$-Brownian motions ($G$-BSDEs for short) with mean reflection. In particular, the generator is allowed having quadratic growth in $z$. Combining a representation of the solution with $G$-BMO martingale techniques, fixed point argument, and $\theta$-method, existence and uniqueness results for such $G$-BSDEs are provided under bounded and unbounded terminal condition. In addition, the mean constraint can be generalized to a risk constraint for financial application. This is a joint work with Yiqing Lin and Kun Xu.

## Mean reflected BSDEs driven by a marked point process

**Kun Xu, 徐坤**
*Shanghai Jiao Tong University*

**Abstract**: We studied a class of mean reflected backward stochastic differential equation driven by a marked point process (MPP) and a Brownian motion. The MPP only need to be non-explosive and to have totally inaccessible jumps. By Lipschitz assumptions on the generators and proper integrability on the terminal value, we give the well-posedness of this kind of BSDEs by combining a representation theorem with the fixed point argument. Besides, we provide a financial application of our results on super-hedging problems, along with an insurance re-payment, under running risk management constraints. This is a joint work with Zihao Gu and Yiqing Lin.

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# IS 05: 随机偏微分方程

## Uniqueness in law for a class of stochastic 2D fluid dynamics equations with transport noise

**Dejun Luo, 罗德军**
*Academy of Mathematics and Systems Science, CAS*

**Abstract**: A fundamental open problem in fluid dynamics is whether solutions to 2D Euler equations with $(L^1_x \cap L^p_x)$-valued vorticity are unique, for some $p \in [1, \infty)$. A related question, more probabilistic in flavour, is whether one can find a physically relevant noise regularizing the PDE. We present some substantial advances towards a resolution of the latter, by establishing well-posedness in law for solutions with $(L^1_x \cap L^2_x)$-valued vorticity and finite kinetic energy, for a general class of stochastic 2D fluid dynamical equations, including logarithmically regularized 2D Euler and hypodissipative 2D Navier–Stokes equations. In the first case, our result solves the open problem posed by Flandoli in 2017. In the latter case, for well-chosen forcing $f$, the corresponding deterministic PDE without noise has recently been shown by Albritton and Colombo to be ill-posed; consequently, the addition of noise truly improves the solution theory for such PDE.

## Strichartz and local smoothing estimates for stochastic dispersive equations

**Deng Zhang, 张登**
*Shanghai Jiao Tong Unviersity*

**Abstract**: Strichartz and local smoothing estimates play the key roles in the theory of dispersive equations. In this talk, we will show the pathwise Strichartz and local smoothing estimates for a general class of stochastic dispersive equations driven by linear multiplicative noise, including especially the stochastic Schroedinger and Airy equations. Several applications to stochastic nonlinear problems will then be given, including the pathwise well-posedness, the high integrability of stochastic solutions and the large deviation principle for the small noise asymptotics.

## Global well-posedness of 3D stochastic Burgers equation with random initial data

**Guoli Zhou, 周国立**
*Chongqing University*

**Abstract**: Global well-posedness for 3D Burgers equation with $L^2(T^3;R^3)$ valued initial data is unsolved. Here, by a suitable randomization for the initial data in $L^2(T^3;R^3)$, we are able to establish the local existence and uniqueness of weak solutions for 3D Burgers equation with additive noise. Then by introducing a regularization random system, we obtain the uniform a priori estimates , which leads to the global existence of the weak solutions. Backward uniqueness is also established. That is, if two solutions intersect at some time $T(>0)$, then they must coincide with each other before. If the initial data is a $H^{\frac{1}{2}}(T^3)$ valued random variable, then all the results of additive case can be extended to linear multiplicative. (Collaborate with Z.Brzezniank, Zhao Dong.)

## On the regularisation of reaction-diffusion equations by the Wight-Fisher white noise

**Zhenyao Sun, 孙振尧**
*Beijing Institute of Technology*

**Abstract**: We give the weak uniqueness of a class of one-dimensional stochastic reaction-diffusion equations with Wright-Fisher white noise. Our results cover examples such as

$$\partial_t u_t = \frac{1}{2}\partial_x^2 u_t + u_t^\alpha(1-u_t) + \sqrt{u_t(1-u_t)}\dot{W},$$

where $\alpha \in [0,1]$ and $W$ is a space-time white noise. Traditionally, the weak uniqueness of this equation is only established when $\alpha = 1$. However, recent work (Comm. Math. Phys. **384** (2021), no. 2) has shown that this weak uniqueness also holds when $\alpha \in [\frac{1}{2}, 1)$, provided the initial value $u_0$ has a compact interface. Our results imply the weak uniqueness of the aforementioned example for every $\alpha \in [0,1)$ without any assumptions regarding the support of the initial value. This is based on ongoing joint work with Clayton Barnes and Leonid Mytnik.

# IS 06: 复杂随机非线性系统的稳定与控制

## Stabilization of stochastic nonlinear delay systems via the event-triggered control method

**Quanxin Zhu, 朱全新**
*Hunan Normal University*

**Abstract**: In this report, we introduce the stabilization problem of stochastic nonlinear delay systems with exogenous disturbances via the event-triggered feedback control method. By introducing the notation of input-to-state practical stability and an event-triggered strategy, we establish the input-to-state practically exponential mean-square stability of the suggested system. Moreover, we investigate the stabilization result by designing the feedback gain matrix and the event-triggered feedback controller, which is expressed in terms of linear matrix inequalities. Also, the lower bounds of inter-execution times by the proposed event-triggered control method are obtained. Finally, an example is given to show the effectiveness of the proposed method. Compared with large number of results for discrete-time stochastic systems, only a few results have appeared on the event-triggered control for continuous-time stochastic systems. In particular, there has been no published papers on the event-triggered control for continuous-time stochastic delay systems. Our work is a first try to fill the gap on the topic.

## Mean square exponential stability and practical mean square exponential stability of stochastic delay differential equations driven by G-Brownian motion and Euler-Maruyama approximation

**Haiyan Yuan, 袁海燕**
*Heilongjiang Institute of Technology*

**Abstract**: This paper focuses on the mean-square (MS) exponential stability and the practical MS (PMS) exponential stability of stochastic delay differential equations driven by G-Brownian motion (G-SDDEs) and numerical solutions generated by the Euler-Maruyama (EM) method. We present a weaker condition to ensure the MS exponential stability of G-SDDEs instead of employing a Lyapunov function when the origin is an equilibrium point. We introduce the concept of practical stability to examine whether the performance of G-SDDEs near an unstable equilibrium point is acceptable, and then establish a new generalized Gronwall inequality to prove the PMS exponential stability of G-SDDEs. For the numerical solutions of G-SDDEs, we first establish the stability equivalence between the discrete and the continuous EM approximations and then show that the continuous EM approximation preserves the MS and the PMS exponential stabilities of G-SDDEs under some restrictions on the step size.

## The novel Markov and semi-Markov switching conditions for the stability of the stochastic jump systems

**Bao Wang, 王豹**
*Xuzhou University of Technology*

**Abstract**: The stochastic jump system is a special hybrid system that consists of a class of subsystem modes and a stochastic switching signal that can orchestrates these modes. When the switching signals are modelled as Markov processes or semi-Markov processes, the corresponding systems can be called Markov jump systems or semi-Markov jump systems. The

stability analysis problems for the above two types of systems have received much attention and achieved many valuable results. But there are still exist some challenging problems need to be discussed. For example, how the switching signal plays the positive coordinative effect on the stability of the considered systems with some unstable modes.

In our research, by taking full advantage of the probability structure of the Markov or semi-Markov switching signal (for example generator matrix, stationary distributions, transition probabilities between different modes, probability distributions of sojourn time of each modes), the novel Markov or semi-Markov switching conditions can be constructed to eliminate the negative effect of unstable subsystems and guarantee the stability of the corresponding stochastic jump systems.

## Finite-time input-to-state stability of nonlinear stochastic impulsive time-varying systems

**Meng Zhang, 张萌**
*Shandong University of Finance and Economics*

**Abstract**: In this talk, we extend the finite-time input-to-state stability (*FTISS*) to stochastic impulsive time-varying nonlinear systems. Meanwhile, we allow the coefficients of the estimated upper bound for the diffusion operator of a Lyapunov function to be time-varying. Also, a relaxed relation between the impulsive frequency is provided. By the Lyapunov function, Lambert $W$ function and average impulsive interval (*AII*) method, several sufficient conditions are provoded to obtain *ISS* property of stochastic impulsive systems in the framework of finite time.

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# IS 07: 随机分析与最优传输问题

## Bisexual Branching Processes

**Yingqiu Li, 李应求**
*Changsha University of Science and Technology*

**Abstract**: The research progress of bisexual branching process is briefly introduced. For a bisexual branching process in a random environment, the conditional mean growth rate per mating unit is introduced, and its related properties are studied, then the upper and lower bounds of conditional mean of the process are obtained. The limiting behaviors of the number of mating units in each generation normalized by these two bounds are respectively investigated. Particularly, the limiting behaviors of the number of females and males in each generation normalized by slightly modified bounds are discussed too, and equivalence theorems between the normalized number of mating units and that of females or males in each generation are obtained.

## An optimal transport approach to ABP estimate on metric measure spaces

**Bang-Xian Han, 韩邦先**
*University of Science and Technology of China*

**Abstract**: I will show how to use optimal transport to generalize Alexandroff–Bakelman–Pucci (ABP) estiamte, to non-smooth metric measure spaces. We obtain an ABP estimate on met-

ric measure spaces with Ricci curvatures bounded from below, and apply this estimate to study several geometric inequalities.

## Uniqueness of the Fokker-Planck equation and Liouville property

**Bin Qian, 钱斌**
*Changshu Institute of Technology*

**Abstract**: In this talk, first I review some known results on uniqueness of the Fokker-Planck equation and related Liouville property, then I will give a necessary and sufficient condition for $L^1$ uniqueness of the Fokker-Planck equation in one dimension. For the multidimensional case, I will give sufficient conditions for $L^1$ uniqueness of the Fokker-Planck equation via comparison with one dimensional case. The associated Liouville property will also be mentioned. Based on the joint work with Prof. Liming Wu.

## Stochastic parallel translations and Q-Brownian motions on the Wasserstein space

**Hao Ding, 丁昊**
*Academy of Mathematics and Systems Science, CAS*

**Abstract**: Firstly, I will briefly introduce researches on Brownian motions and diffusion processes on the probability measure space. Then, based on the infinite dimensional Riemannian structure of the Wasserstein space introduced by F.Otto, I will introduce some elements in stochastic analysis on the Wasserstein space $\mathbb{P}_2(M)$ over a compact Riemannian manifold $M$, such as intrinsic Itô formula of three kinds of functionals, stochastic regular curves and parallel translations along them and a kind of renormalized Brownian motion. I will show the well-posedness of J. Lott's equation for parallel translations in the case of $\mathbb{P}_2(\mathbb{T})$. Also, the existence of parallel translations along stochastic regular curves can be established. These are based on the joint work with Xiangdong Li and Shizan Fang.

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# IS 08: 随机系统的分析与控制

## Viscosity Solutions to Second Order Path-Dependent Hamilton-Jacobi-Bellman Equations

**Jianjun Zhou, 周建军**
*Northwest A&F University*

**Abstract**: In this talk, a notion of viscosity solutions is introduced for second order path-dependent Hamilton-Jacobi-Bellman (PHJB) equations associated with optimal control problems for path-dependent stochastic differential equations. We identify the value functional of optimal control problems as unique viscosity solution to the associated PHJB equations.

## Backward stochastic Volterra integral equations driven by fractional Brownian motions

**Jinbiao Wu, 吴锦标**
*Central South University*

**Abstract**: In this talk, I will present some recent results on backward stochastic Volterra integral equations driven by fractional Brownian motions. Notion of adapted fraction M-solution is introduced. The fractional Clark-Ocone formula under change of measure is established. A Pontryagin type maximum principle is presented.

## Multidimensional BSDEs with rough drifts

**Jiahao Liang, 梁嘉豪**
*Fudan University*

**Abstract**: In this talk we are concerned with a multidimensional backward stochastic differential equation (BSDE) with a rough drift. With a flow transform method, we give the existence and uniqueness of the adapted solution for terminal value and geometric rough path sufficiently small. In particular, when the rough drift is linear but allowed to be random and time-varying, we first introduce the $p$-rough stochastic integration for $p \in [2, 3)$, and then give via a fixed-point argument a general existence and uniqueness result for the multidimensional rough BSDE with a general square integrable terminal value. Furthermore, we connect it to a system of rough partial differential equations. This talk is based on a joint work with Prof. Shanjian Tang.

## New results on backward stochastic differential equations

**Shanjian Tang, 汤善健**
*Fudan University*

**Abstract**: In this talk, we review some new results for solution of 1D backward stochastic differential equations. In particular, we give connection of the integrability of the terminal condition $\xi$ to the nonlinearity of the generator $g(t, y, z)$ in the second unknown variable $z$ if the BSDE has a global adapted solution. This talk is based on my jointed papers with Shengjun Fan, Ying Hu, et al..

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# IS 09: 马氏过程与微分方程

## The first exit time of fractional Brownian motion with a Drift from a parabolic domain

**Dawei Lu, 鲁大伟**
*Dalian University of Technology*

**Abstract**: We study the first exit time of a fractional Brownian motion with a drift from a parabolic domain. Actually, we explore three different regimes. In the first regime, the role of drift is negligible. In the second regime, the role of drift is dominating. The behavior of exit probability is the same as that of the crossing probability of a certain moving non-random boundary. In particular, the most interesting, intermediate regime, where all factors come into play, has been solved in this paper. Finally, numerical simulations are conducted, providing

an approximate range for the asymptotic estimates to illustrate the practical implications and potential applications of our main results.

## Optimal per-loss reinsurance and investment with common shock dependence to minimize the probability of draw down before draw up for an AAI

**Jieming Zhou, 周杰明**
*Hunan Normal University*

**Abstract**: This paper considers a robust optimal investment and reinsurance problem in a risk model with two dependent classes of insurance business for an Ambiguity-Averse Insurer (AAI), who wishes to minimize the probability of drawdown before drawup. The insurer is allowed to purchase per-loss reinsurance for every class of insurance business and the reinsurance premium is computed according to the mean-variance premium principle. By applying stochastic dynamic programming based on the Hamilton-Jacobi-Bellman (HJB) equation, the robust optimal investment-reinsurance strategy and the associated value function are derived. Finally, numerical examples are performed to obtain sensitivity analysis.

## The probabilistic solution of a system of semilinear elliptic PDEs under the third boundary conditions

**Junxia Duan, 段军霞**
*Central South University*

**Abstract**: The earliest work of using probabilistic approaches to solve the boundary value problem of second order differential operators can be traced back to Kakutani in 1944, which started a new era between probability theory and analysis. Since then, it has been developed by many authors. In this talk, we will establish existence and uniqueness of weak solution to the third boundary value problem for a class of semilinear elliptic PDEs with singular coefficients. Our method is probabilistic. The gauge theory and BSDEs with singular coefficients play an important role in our approach. The talk is based on a joint work with Prof. Jun Peng.

## Dirichlet boundary value problem for Integral-Differential equations

**Jun Peng, 彭君**
*Central South University*

**Abstract**: In this paper, we prove that there exists a unique weak solution to the Dirichlet boundary value problem for a class of integral-differential operators. Our approach is probabilistic and we give the probabilistic representation of solutions for the PDE.

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# IS 10: 马氏过程稳定性及应用

## Hoeffding's inequality for continuous-time Markov processes

**Yuanyuan Liu, 刘源远**
*Central South University*

**Abstract**: This talk will focus on Hoeffding's inequality for continuous-time Markov processes. We will present two distinct methods for establishing this inequality. The first approach

is based on a martingale difference sequence in terms of a solution of Poisson's equation. Hoeffding's inequality is established by deriving upper bounds on a solution of Poisson's equation in terms of the first hitting times and the drift condition. The second method is based on the spectral gap, the skeleton chain and the technique of augmented truncation for continuous-time Markov processes. Our result extends a sharp Hoeffding's inequality in Fan et al. (2020) for discrete-time Markov chains to the continuous-time Markov processes on a countable state space. Finally, we will provide several examples to illustrate our results.

## Systematic approaches to generate reversiblizations of non-reversible Markov chains

**Michael Choi, 蔡卓轩**
*National University of Singapore*

**Abstract**: Given a target distribution $\pi$ and an arbitrary Markov infinitesimal generator $L$ on a finite state space $\mathcal{X}$, we develop three structured and inter-related approaches to generate new reversiblizations from $L$. The first approach hinges on a geometric perspective, in which we view reversiblizations as projections onto the space of $\pi$-reversible generators under suitable information divergences such as $f$-divergences. Different choices of $f$ allow us to recover almost all known reversiblizations while at the same time unravel and generate new reversiblizations. Along the way, we give interesting geometric results such as bisection properties, Pythagorean identities, parallelogram laws and a Markov chain counterpart of the arithmetic-geometric-harmonic mean inequality governing these reversiblizations. This also motivates us to introduce the notion of information centroids of a sequence of Markov chains and to give conditions for their existence and uniqueness. Building upon the first approach, we view reversiblizations as generalized means in the second approach, and construct new reversiblizations via different natural notions of generalized means such as the Cauchy mean or the dual mean. In the third approach, we combine the recently introduced locally-balanced Markov processes framework and the notion of convex $*$-conjugate in the study of $f$-divergence. The latter offers a rich source of balancing functions to generate new reversiblizations.

## Wasserstein Convergence for Empirical Measures of Mixing Sequences and Random Walks

**Lu-Jing Huang, 黄璐静**
*Fujian Normal University*

**Abstract**: The mean convergence rates in general Wasserstein distance $\mathcal{W}_p (p \geq 1)$ for the empirical measures of mixing sequences and random walks are characterized. Additionally, assuming a spectral gap assumption, we establish the almost sure convergence rate for the empirical measure of random walk on the torus. Based on joint work with Bingyao Wu.

## Variational formulas for the exit time of Hunt processes generated by semi-Dirichlet forms

**Tao Wang, 王涛**
*Jiangsu Normal University*

**Abstract**: Variational formulas for the Laplace transform of the exit time from an open set of a Hunt process generated by a regular lower bounded semi-Dirichlet form are established. While for symmetric Markov processes, variational formulas are derived for the exponential moments of the exit time. As applications, we provide some comparison theorems and quantitative relations of the exponential moments and Poincaré inequalities.

# IS 11: 概率渐近理论

## From $p$-Wasserstein bounds to moderate deviations

**Xiao Fang, 方笑**
*The Chinese University of Hong Kong*

**Abstract**: We use a new method via $p$-Wasserstein bounds to prove Cramér-type moderate deviations in (multivariate) normal approximations. In the classical setting that $W$ is a standardized sum of $n$ independent and identically distributed (i.i.d.) random variables with sub-exponential tails, our method recovers the optimal range of $0 \le x = o(n^{1/6})$ and the near optimal error rate $O(1)(1+x)(\log n + x^2)/\sqrt{n}$ for $P(W > x)/(1-\Phi(x)) \to 1$, where $\Phi$ is the standard normal distribution function. Our method also works for dependent random variables (vectors) and we give applications to the combinatorial central limit theorem, Wiener chaos, homogeneous sums and local dependence. The key step of our method is to show that the $p$-Wasserstein distance between the distribution of the random variable (vector) of interest and a normal distribution grows like $O(p^\alpha \Delta)$, $1 \le p \le p_0$, for some constants $\alpha, \Delta$ and $p_0$. In the above i.i.d. setting, $\alpha = 1, \Delta = 1/\sqrt{n}, p_0 = n^{1/3}$. For this purpose, we obtain general $p$-Wasserstein bounds in (multivariate) normal approximations using Stein's method. This is joint work with Yuta Koike.

## Cramér's moderate deviations for martingales with applications

**Xiequan Fan, 范协铨**
*Northeastern University at Qinhuangdao*

**Abstract**: Let $(\xi_i, \mathcal{F}_i)_{i\ge1}$ be a sequence of martingale differences. Set $X_n = \sum_{i=1}^n \xi_i$ and $\langle X\rangle_n = \sum_{i=1}^n \mathbf{E}(\xi_i^2|\mathcal{F}_{i-1})$. We present some Cramér's moderate deviation expansions for $\mathbf{P}(X_n/\sqrt{\langle X\rangle_n} \ge x)$ and $\mathbf{P}(X_n/\sqrt{\mathbf{E}X_n^2} \ge x)$ as $n \to \infty$. Our results extend the classical Cramér result to the cases of normalized martingales $X_n/\sqrt{\langle X\rangle_n}$ and standardized martingales $X_n/\sqrt{\mathbf{E}X_n^2}$, with martingale differences satisfying the conditional Bernstein condition. Applications to elephant random walks and autoregressive processes are also discussed.

## Asymptotic behavior of step-reinforced random walks

**Zhishui Hu, 胡治水**
*University of Science and Technology of China*

**Abstract**: A step-reinforced random walk is a discrete-time non-Markovian process with long range memory. At each step, with a fixed probability $p$, the positively step-reinforced random walk repeats one of its preceding steps chosen uniformly at random, and with complementary probability $1-p$, it has an independent increment. The negatively step-reinforced random walk follows the same reinforcement algorithm but when a step is repeated its sign is also changed. In this talk, we study some limiting results for positively and negatively step-reinforced random walks.

## Robust estimation for number of factors in high dimensional factor modeling via Spearman correlation matrix

**Zeng Li, 李曾**
*Southern University of Science and Technology*

**Abstract**: Determining the number of factors in high-dimensional factor modeling is essential but challenging, especially when the data are heavy-tailed. In this paper, we introduce a new

estimator based on the spectral properties of Spearman correlation matrix under the high-dimensional setting, where both dimension and sample size tend to infinity proportionally. The estimator is robust against heavy tails in either the common factors or idiosyncratic errors. The consistency of the estimator is established under mild conditions. Numerical experiments also demonstrate the superiority of our estimator compared to existing methods, especially for the heavy-tailed case.

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# IS 12: 随机分析及马氏决策相关问题

## Bismut-Elworthy-Li Formulae for Forward-Backward Stochastic Differential Equations Driven by Poisson Random Measures and Application to Nonlocal Quasi-Linear Integral-PDEs

**Hua Zhang, 张华**
*Jiangxi University of Finance and Economics*

**Abstract**: Under nondegeneracy assumptions on the diffusion coefficient, we establish the derivative formulae of Bismut-Elworthy-Li's type for forward-backward stochastic differential equations with respect to Poisson random measure using the lent particle method created by Bouleau and Denis, which is not given before. Applying this formulae, the existence and uniqueness of a solution of nonlocal quasi-linear integral-PDEs which is differentiable with respect to the space variable, even if the initial datum and coefficients of this equation are not.

## Central limit theorems for the derivatives of self-intersection local time for $d$-dimensional Brownian motion

**Xianye Yu, 余显烨**
*Zhejiang Gongshang University*

**Abstract**: Let $\{B_t, t \geq 0\}$ be a d-dimensional Brownian motion. We prove that the approximation of the higher derivative of renormalized self-intersection local time

$$\alpha_d^{(|k|)}(\epsilon) - E[\alpha_d^{(|k|)}(\epsilon)] := \int_0^1 \int_0^s \left( p_{d,\epsilon}^{(|k|)}(B_s - B_r) - E[p_{d,\epsilon}^{(|k|)}(B_s - B_r)] \right) drds,$$

where the multiindex $k = (k_1, \cdots, k_d)$, $p_{d,\epsilon}^{(|k|)}(x_1, x_2, \cdots, x_d) := \partial_{x_1}^{k_1} \partial_{x_2}^{k_2} \cdots \partial_{x_d}^{k_d} p_{d,\epsilon}(x_1, x_2, \cdots, x_d)$ and $p_{d,\epsilon}(x) = \frac{e^{-\frac{|x|^2}{2\epsilon}}}{(2\pi\epsilon)^{d/2}}$, satisfies the central limit theorems when renormalized by $(\log \frac{1}{\epsilon})^{-1}$ in the case $d = 2$, $|k| = 1$ and by $\epsilon^{\frac{d+|k|-3}{2}}$ in the case $d \geq 3$, $|k| \geq 1$, which gives a complete answer to the conjecture of Markowsky [In Séminaire de Probabilitiés XLIV (2012) 141-148 Springer]. We as well prove that the m-th chaotic component of $\alpha_d^{(|k|)}(\epsilon) - E[\alpha_d^{(|k|)}(\epsilon)]$ satisfies the central limit theorems when renormalized by a multiplicative factor in different cases.

## Zero-sum semi-Markov games with the risk-sensitive average reward criterion

**Fang Chen, 陈方**
*Sun Yat-sen University*

**Abstract**: We consider the risk-sensitive average reward criterion for the semi-Markov game with compact state and action spaces. Under some suitable conditions (slightly weaker than the existing ones), we introduce a parametric operator, verify that the corresponding spectral radius is an engenvalue of it by the Krein-Rutman theorem, and further show the continuity of the spectral radius in the parameters. By the continuity and the mean value theorem, we prove that the Shapley equation admits a solution, and then establish the existence of the value and a stationary saddle point. Furthermore, we present an iteration algorithm for computing (at least approximating) the value of the game. Finally, we give two examples to illustrate our conditions and algorithm.

## On the equivalence of viscosity and distribution solutions of second-order semi-linear PDEs with Neumann boundary

**Shoutian Wang, 王首天**
*Sun Yat-sen University*

**Abstract**: In this talk, we get the representation of viscosity solutions to semi-liear PDEs and we apply a probabilistic approach to prove that the viscosity solutions and the distribution solutions to the Neumann problem of second order semi-linear elliptic equations are equivalent. We will then focus on a more general type of PDEs by using generalized FBSDE methods. We establish the existence and uniqueness of the solutions to generalized FBSDEs. After investigating continuity of these solutions, we extend our main result under this situation.

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# IS 13: 分枝过程及相关课题

## Exact convergence rate for the distribution of particles in a branching random walk with immigration

**Zhiqiang Gao, 高志强**
*Beijing Normal University*

**Abstract**: Consider a discrete time branching random walk with immigration in $d$-dimensional integer lattice. The exact convergence rate of the local limit theorem for the particle distributions of the process is obtained.

## Poisson approximation for the level sets of parabolic Anderson model

**Fei Pu, 蒲飞**
*Beijing Normal University*

**Abstract**: We consider the number of spatial points of the solution to parabolic Anderson model that exceeds a certain level. Assuming a distance condition on these spatial points, we formulate a Poisson limit theorem, using Poincare inequality and the asymptotic behavior

of tail probability of the solution to parabolic Anderson model. The approach also applies to Poisson approximation for some other Gaussian functionals. This is based on ongoing collaboration with Davar Khoshnevisan.

## Martingales in a branching Lévy process

**Quan Shi, 石权**
*Academy of Mathematics and Systems Science, CAS*

**Abstract**: In the study of the branching Brownian motion, the convergence of the derivative martingale is of significant interest, since the limit can be used to study the travelling wave solutions of the FKPP (Fisher-Kolmogorov-Petrovskii-Piskunov) equation.

Recently, Bertoin introduces branching Lévy processes, generalizing the branching Brownian motion to a very general class of branching particle systems. For a branching Lévy process, we obtain a necessary and sufficient condition for the convergence of the derivative martingale to a non-trivial limit. This extends results for branching Brownian motions and branching random walks. Joint work with Bastien Mallein.

## Well-posedness of the martingale problem for super-brownian motion with interactive branching

**Xu Yang, 杨叙**
*North Minzu University*

**Abstract**: In this talk a martingale problem for super-Brownian motion with interactive branching is derived. The uniqueness of the solution to the martingale problem is obtained by using the pathwise uniqueness of the solution to a corresponding system of SPDEs with proper boundary conditions. The existence of the solution to the martingale problem and the local Hölder continuity of the density process are also studied. This talk is based on a joint work with Lina Ji and Jie Xiong.

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# IS 14: 随机偏微分方程

## Remarks on SDEs with divergence free drifts and their applications

**Guohuan Zhao, 赵国焕**
*Academy of Mathematics and Systems Science, CAS*

**Abstract**: In this talk, I will share some well-known results about stochastic differential equations with singular coefficients. Afterwards, I will focus on a specific case where the drift coefficients are divergence-free. Our main emphasis will be on the well-posed problem and density estimations of the corresponding diffusion processes. Specifically, I will explore situations where the dimension is either 2 or 3, and the drift coefficients only satisfy some integrability conditions. Furthermore, I will demonstrate how these results can be applied to tackle nonlinear Fokker-Planck equations that involve singular nonlinear terms.

## Large deviations of invariant measure for the 3D stochastic hyperdissipative Navier-Stokes equations

**Zhaoyang Qiu, 邱召阳**
*Nanjing University of Finance and Economic*

**Abstract**: In this paper, we consider the large deviations of invariant measure for the 3D stochastic hyperdissipative Navier-Stokes equations driven by additive noise. The unique ergodicity of invariant measure as a foundational result is proved using a deterministic argument by the exponential moment and exponential stability estimates. Then, the uniform large deviations is established by the uniform contraction principle. Finally, using the unique ergodicity and the uniform large deviations results, we prove the large deviations of invariant measure by verifying the Freidlin-Wentzell large deviations upper and lower bounds.

## Eventual continuity approach to verifying unique ergodicity of SPDEs

**Ziyu Liu, 刘子愉**
*Peking University*

**Abstract**: We formulate a new criterion of the asymptotic stability for some non-equicontinuous Markov semigroups, the so-called eventually continuous semigroups. In particular, we provide a non-equicontinuous Markov semigroup example with essential randomness, which is asymptotically stable. We further apply the eventual continuity approach to the study of the ergodicity of stochastic partial differential equations with multiplicative noise. We apply the generalized coupling method to verify the eventual continuity and combine it with the uniform irreducibility to verify the unique ergodicity.

## Scaling limit of moderately interacting particle systems with singular interaction and environmental noise

**Shuchen Guo, 郭书晨**
*University of Oxford*

**Abstract**: We consider moderately interacting particle systems with singular interaction kernels and environmental noise. It is shown that the mollified empirical measures converge in strong norms to the unique (local) solutions of nonlinear Fokker-Planck equations. The approach works for the Biot-Savart and repulsive Poisson kernels.

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# IS 15: Complex big data analysis in modern statistics

## Robust Personalized Federated Learning with Sparse Penalization

**Xiaofei Zhang, 章晓菲**
*Zhongnan University of Economics and Law*

**Abstract**: Federated learning is an emerging topic thanks to its advantage in collaborative learning with distributed data. Due to the heterogeneity in the local data-generating mechanism, it is important to consider personalization when developing federated learning methods. In this work, we propose a personalized federated learning method for addressing

the robust regression problem. Specifically, we aim to learn the regression weight by solving a Huber loss with the sparse fused penalty. Additionally, we designed our personalized federated learning for robust and sparse regression algorithm to solve the estimation problem in the federated system efficiently. Theoretically, we show the proposed algorithm reaches a convergency rate of $\mathcal{O}(1/T)$, and the proposed estimator is statistically consistent. Thorough experiments and real data analysis are conducted to corroborate the theoretical results of our proposed personalized federated learning method.

## Distributed Semi-Supervised Sparse Statistical Inference

**Xiaojun Mao, 毛晓军**
*Shanghai Jiao Tong University*

**Abstract**: This paper is devoted to studying the semi-supervised sparse statistical inference in a distributed setup. An efficient multi-round distributed debiased estimator, which integrates both labeled and unlabelled data, is developed. We will show that the additional unlabeled data helps to improve the statistical rate of each round of iteration. Our approach offers tailored debiasing methods for $M$-estimation and generalized linear model according to the specific form of the loss function. Our method also applies to a non-smooth loss like absolute deviation loss. Furthermore, our algorithm is computationally efficient since it requires only one estimation of a high-dimensional inverse covariance matrix. We demonstrate the effectiveness of our method by presenting simulation studies and real data applications that highlight the benefits of incorporating unlabeled data.

## Correlated Quantization for Distributed Mean Estimation: A Sampler Perspective

**Hengfang Wang, 王恒放**
*Fujian Normal University*

**Abstract**: The increasing size of data has created a pressing need for communication and data privacy protection, which has spurred significant interest in quantization. This paper proposes a novel scheme for quantization called variance reduced correlated quantization (VRCQ) that is specifically designed for data with bounded support and distributed mean estimation. Our method is shown to achieve a theoretical reduction in mean square error for both fixed and randomized designs compared to the correlated quantization method, under different levels and dimensions scenarios. We conducted several synthetic data experiments to illustrate the effectiveness of our approach and to provide a good approximation of the reduced mean square error based on our theory. We further applied our proposed method to real-world data with different learning tasks, and it produced promising results.

## Transductive Matrix Completion with Calibration for Multi-Task Learning

**Zhonglei Wang, 王中雷**
*Xiamen University*

**Abstract**: Multi-task learning has attracted much attention due to growing multi-purpose research with multiple related data sources. Moreover, transduction with matrix completion is a useful method in multi-label learning. In this paper, we propose a transductive matrix completion algorithm that incorporates a calibration constraint for the features under the multi-task learning framework. The proposed algorithm recovers the incomplete feature matrix and target matrix simultaneously. Fortunately, the calibration information improves the

completion results. In particular, we provide a statistical guarantee for the proposed algorithm, and the theoretical improvement induced by calibration information is also studied. Moreover, the proposed algorithm enjoys a sub-linear convergence rate. Several synthetic data experiments are conducted, which show the proposed algorithm out-performs other methods, especially when the target matrix is associated with the feature matrix in a nonlinear way.

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## IS 16: 相依过程的极限不等式与相关极限定理

### Talagrand's quadratic transportation cost inequalities for reflected SPDEs

**Yumeng Li, 李宇勐**
*Zhongnan University of Economics and Law*

**Abstract**: We study the Talagrand concentration inequalities for reflected stochastic partial differential equations, continuing the work of D. Khoshnevisan and A. Sarantsev [Stoch. Partial Differ. Equ. Anal. Comput. (2019)] on their non-reflected versions. Talagrand concentration inequalities compare two quantities: Wasserstein distance from the distribution of the process to a test distribution; and relative entropy of the latter with respect to the former. This family of inequalities has applications for large deviations and tail estimates.

### Large and moderate deviations for Kac-Stroock type of approximation and their application

**Qingshan Yang, 杨青山**
*Northeast Normal University*

**Abstract**: For a class of Volterra type of integral over Kac-Stroock type of approximation, we establish large and moderate deviations for the the sample path under proper norms. As the application, some examples for inhomogeneous telegraph processes are illustrated.

### The Foster-Lyapunov conditions for stochastic stability of discrete-time Markov chains

**Yan-Hong Song, 宋延红**
*Zhongnan University of Economics and Law*

**Abstract**: We consider Foster-Lyapunov conditions for transience and recurrence of discrete-time Markov chains separately. For transience, we obtain one step Foster-Lyapunov conditions for geometric transience and algebraic transience through bounding the modified moment of the first return times. For recurrence, we establish three types of Foster-Lyapunov conditions for algebraic ergodicity, including Foster-Lyapunov conditions for fixed state dependent times, Foster-Lyapunov conditions for random state dependent times and history dependent Foster-Lyapunov conditions.

## Transition Density of an Infinite-dimensional diffusion with the Jack Parameter

**Youzhou Zhou, 周友洲**
*Xi'an Jiaotong-Liverpool University*

**Abstract**: From the Poisson-Dirichlet diffusions to the $Z$-measure diffusions, they all have explicit transition densities. In this paper, we will show that the transition densities of the $Z$-measure diffusions can also be expressed as a mixture of a sequence of probability measures on the Thoma simplex. The coefficients are still the transition probabilities of the Kingman coalescent stopped at state 1. This fact will be uncovered by a dual process method in a special case where the $Z$-measure diffusions is established through up-down chain in the Young graph.

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# IS 17: 分数布朗运动驱动的随机系统的分析

## SPDEs with gradient driven by fractional noises

**Yiming Jiang, 江一鸣**
*Nankai University*

**Abstract**: We study a class of SPDEs driven by space-time fractional noises, where we suppose that the drift term or diffusion term contain a gradient and satisfies certain conditions. We prove the existence and uniqueness and joint Hölder continuity on the solution to the SPDEs.

## Asymptotic properties of fractional Ornstein-Uhlenbeck process

**Hui Jiang, 蒋辉**
*Nanjing University of Aeronautics and Astronautics*

**Abstract**: In this talk, we study the deviation inequalities for some quadratic functionals in stationary and explosive fractional Ornstein-Uhlenbeck process. Then, Cramér-type moderate deviations for the least square estimator are obtained via asymptotic analysis techniques.

## Gaussian fluctuation for spatial average of the stochastic partial differential equation with fractional noise

**Junfeng Liu, 刘俊峰**
*Nanjing Audit University*

**Abstract**: Consider a class of stochastic partial differential equation on $R$ of the form

$$\frac{\partial}{\partial t}u(t,x) = -\mathcal{L}u(t,x) + \sigma(u(t,x))\dot{W}(t,x),$$

where $\mathcal{L}$ is a nonlocal pseudo-differential operator and $\dot{W}$ denotes a Gaussian noise which is white in time and has a covariance function of fractional Brownian motion with Hurst index $H \in [1/2, 1)$ with respect to the spatial variable. We prove that the normalized spatial average of the solution from $-L$ to $L$ $(L > 0)$ converges in total variance distance to a standard normal distribution as $L$ tends to infinity. We also establish a functional version of this central limit theorem. The Malliavin-Stein's method plays an important role.

## Analysis of the gradient for the stochastic fractional heat equation with spatially-colored noise

**Ran Wang, 王冉**
*Wuhan University*

**Abstract**: Consider the stochastic partial differential equation

$$\frac{\partial}{\partial t}u_t(x) = -(-\Delta)^{\frac{\alpha}{2}}u_t(x) + b\left(u_t(x)\right) + \sigma\left(u_t(x)\right)\dot{F}(t,x), \quad t \geq 0, x \in R^d,$$

where $-(-\Delta)^{\frac{\alpha}{2}}$ denotes the fractional Laplacian with the power $\alpha/2 \in (1/2, 1]$, and the driving noise $\dot{F}$ is a centered Gaussian field which is white in time and with a spatial homogeneous covariance given by the Riesz kernel. We study the detailed behaviors of approximation spatial and temporal gradients. As applications, we deduce the law of iterated logarithm and the behavior of the $q$-variations of the solution. Joint work with Yimin Xiao.

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# IS 18: 极限理论

## Large deviations and gaussian approximation for products of random matrices

**Quansheng Liu, 刘全升**
*Université Bretagne Sud (University of South Brittany)*

**Abstract**: Some recent progress on limit theorems for products of independent and identically distributed random matrices will be presented. We focus on precise large deviations and convergence rates in the Gaussian approximation. Applications to branching processes and branching random walks will also be presented. (Mainly based on joint works with Ion Grama and Hui Xiao, JEMS 2022, Ann. Prob. 2023)

## Large deviation probabilities for the maximum of a two speed branching Brownian motion

**Hui He, 何辉**
*Beijing Normal University*

**Abstract**: In this talk, we first review some basic facts about the maximum of usual branching Brownian motions including weak limit of centered maximum, its associated large deviation probabilities and extremal processes. Then by considering the connections with the so-called generalized random energy model introduced by Derrida and Spohn, we shall go further to understand the two-speed branching Brownian motion. The talk in based on a joint work with Xinxin Chen, Zengcai Chen and Lisa Hartung.

## The generic chainning and $\varphi$-sub-gaussian processes

**Hanchao Wang, 王汉超**
*Shandong University*

**Abstract**: In this talk, we obtain the tail probability inequality of suprema of $\varphi$-sub-gaussian processes by a truncated generic chaining method. Our result is an improvement of classical Dudley's bound. As an application, we provide a concentration inequality on the Johnson-Lindenstrauss lemma.

## Berry-Esseen bounds for generalized U-statistics

**Zhuosong Zhang, 张卓松**
*Southern University of Science and Technology*

**Abstract**: We establish optimal Berry-Esseen bounds for the generalized U-statistics. The proof is based on a new Berry-Esseen theorem for exchangeable pair approach by Stein method under a general linearity condition setting. As applications, an optimal convergence rate of the normal approximation for subgraph counts in Erdös-Rényi graphs and graphon-random graph is obtained.

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# IS 19: 统计物理模型与共形场论

## The extended Seiberg bound: motivations, generalizations and applications

**Yichao Huang, 黄逸超**
*Beijing Institute of Technology*

**Abstract**: The Seiberg bounds form a set of necessary and sufficient conditions under which correlations functions in Liouville conformal field theory are well-defined. Since the probabilistic construction of Liouville correlations functions by David, Kupiainen, Rhodes and Vargas, a probabilistic version of the Seiberg bounds can be obtained via the theory of Gaussian Multiplicative Chaos. We will give a brief review on this construction, and then explain its boundary version, where a new class of Gaussian Multiplicative Chaos emerges naturally. If time permits, we will explain several other applications of the extended Seiberg bound, e.g. to the study of random analytic functions.

## Thermodynamic limit of the first Lee-Yang zero

**Jianping Jiang, 姜建平**
*Tsinghua University*

**Abstract**: For the standard ferromagnetic Ising model on $\mathbb{Z}^d$, we completed the rigorous verification of the proposal by Yang-Lee (1952) and Lee-Yang (1952) that singularities of thermodynamic functions are exactly the limits in the real physical parameter space of finite-volume singularities in the complex plane. Based on joint works with Federico Camia and Charles M. Newman.

## Power law decay at criticality for the q-state antiferromagnetic Potts model on regular trees

**Chenlin Gu, 顾陈琳**
*Tsinghua University*

**Abstract**: We present a proof of the power law decay of magnetic moment for the q-state antiferromagnetic Potts model on the regular tree at the critical temperature, and also justify that the exact exponent is $\frac{1}{2}$. Our proof relies on the assumption of the uniqueness at the critical temperature, which has been established for $q = 3, 4$, and for $q \geq 5$ with large degree. An iterative contraction inequality is developed for independent interests. This talk is based on a joint work with Wei Wu, Kuan Yang.

## Disconnection and entropic repulsion phenomena for Random Interlacements

**Xinyi Li, 李欣意**
*Peking University*

**Abstract**: The model of random interlacements is the Poissonian collection of doubly-infinite random-walk-like trajectories in $Z^d, d \geq 3$. Originally introduced by Sznitman in 2007, this model has received a lot of attention among the probabilist community. In this talk, we discuss some disconnection and entropic repulsion phenomena that emerged from the study of random interlacements. Based on joint works and with Zijie Zhuang (UPenn), and work in progress with Yu Liu (PKU) and Yuanzheng Wang (PKU).

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# IS 20: 马氏过程与随机优化

## Nonzero-sum piecewise deterministic Markov games with infinite-horizon discounted payoffs

**Yonghui Huang, 黄永辉**
*Sun Yat-Sen University*

**Abstract**: This talk is devoted to nozero-sum piecewise deterministic Markov games (PDMGs) with the expected discounted payoffs. Based on an observation on HJB equations satisfied by the best reply functions, we construct a static game associated with the PDMGs. Under some specific assumption on the transition rates, the set-valued mapping, from the uniformly essentially $w$-bounded functions to the set of payoff functions corresponding to all Nash equilibria for the static games, is proven to have a fixed point. Then, using Filippov's measurable implicit function theorem, we show that there exists a Nash equilibrium for the static games associated with the fixed-point functions, which eventually leads to the existence of a stationary Nash equilibrium for the PDMGs.

## Constrained average stochastic games with continuous-time independent state processes

**Wenzhao Zhang, 张文钊**
*Fuzhou University*

**Abstract**: In this talk, we will study nonzero-sum continuous-time constrained average stochastic games with independent state processes. In these game models, each player independently controls a continuous-time Markov chain, but players are coupled by the immediate cost functions. The transition rates and immediate cost functions are allowed to be unbounded. Each player wants to minimize certain expected average cost, but constraints are imposed on other expected average costs. By introducing the average occupation measures, we establish the one-to-one relationship of constrained Nash equilibria of constrained game model and the fixed points of certain multifunction defined on the product space of average occupation measures. Then, by using the fixed point theorem, we show the existence of constrained Nash equilibria. Finally, we show that each stationary Nash equilibrium corresponds to a global minimizer of a certain mathematical program.

## Long time behavior for population model by $\alpha$-stable processes with Markov switching

**Zhenzhong Zhang, 张振中**
*Donghua University*

**Abstract**: In this talk, we focus on extinction or ergodicity for the $n$-dimensional population model driven by $\alpha$-stable processes with Markov switching. Some sufficient conditions for extinction or ergrodicity are given. Our conditions disclose the parameter $\alpha$ and stationary distribution of Markov chain to the impact on the extinction or ergodicity.

## Stabilization of highly nonlinear hybrid stochastic differential delay equations with Lévy noise by delay feedback control

**Hailing Dong, 董海玲**
*Shenzhen University*

**Abstract**: We focuses on a class of highly nonlinear stochastic differential delay equations (SDDEs) driven by Lévy noise and Markovian chain, where the drift and diffusion coefficients satisfy more general polynomial growth condition (than the classical linear growth condition). Under the local Lipschitz condition, the existence-and-unique theorem of the solution to the highly nonlinear SDDE is established. The key aim is to investigate the stabilization problem by delay feedback controls. The key features include that the time delay in the given system is of time-varying and may not be differentiable while the time lag in the feedback control can also be of time-varying as long as it has a sufficiently small upper bound.

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# IS 21: 分布依赖随机微分方程

## Approximation of the ergodic measure of SDEs by Euler-Maruyama scheme with decreasing step sizes

**Lihu Xu, 徐礼虎 & Xiang Li, 李想**
*University of Macau*

**Abstract**: We consider the following stochastic differential equation:

$$dX_t = b(X_t)dt + \sigma dB_t,$$

where $b : \mathbf{R}^d \to \mathbf{R}^d$ is Lipschitz condition and satisfies a certain dissipation condition, and $\sigma$ is a $d \times d$ invertible matrix. We approximate its ergodic measure by an Euler-Maruyama scheme with decreasing step sizes $\{\gamma_n\}_{n\geq 1}$, and prove that the covergence rate is in an order of $\gamma_n$ in both Wasserstein-1 and total variation distances. Note that our result remarkably improves the very recent one by Gilles Pagés and Fabien Panloup, in which they have to assume $b \in C^3$. This is a joint work in progress with Feng-Yu Wang.

## Data assimilation for dissipative system under environment noise

**Guangying Lv, 吕广迎**
*Nanjing University of Information Science and Technology*

**Abstract**: In this talk, we first review the definition of data assimilation introduced by Titi. Then we use feedback control theory to study the data assimilation of dissipative system.

Note that there will be random errors in the measurement and noise always exists in the real world, so we consider data assimilation of dissipative system with random errors under environment noise. We give a new mechanism for data assimilation problem.

## Propagation of Chaos for Mean Field Interacting Particle System with Multiplicative Noise

**Xing Huang, 黄兴**
*Tianjin University*

**Abstract**: In this paper, the quantitative propagation of chaos for mean field interacting particle system with multiplicative noise in Wasserstein distance is obtained. This together with the coupling by change of measure implies the quantitative propagation of chaos in the relative entropy and total variation distance.

## Sensitivity analysis for DDSDEs with jumps

**Yulin Song, 宋玉林**
*Nanjing University*

**Abstract**: By Malliavin calculus for Wiener-Poisson functionals, we establish Bismut type formulas for the parameter of DDSDEs with jumps. As applications, formulas for the Greek Vega are derived for asset price processes described by DDSDEs with jumps. Numerical results illustrate that the obtained formulas have better effects than the finite difference method in computing the Greeks.

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# IS 22: 随机矩阵理论与应用

## Small gaps of point processes

**Dong Yao, 姚东**
*Jiangsu Normal University*

**Abstract**: We consider the small gap problem for a number of point processes, including the eigenvalues of Gaussian symplectic ensemble, zeros of stationary Gaussian processes on the real line and zeros of Gaussian analytic functions. In all these cases, the small gaps tend to a Gumbel distribution.

## Free limit laws for block correlation matrix

**Zhigang Bao, 鲍志刚**
*The Hong Kong University of Science and Technology*

**Abstract**: Independence test for the components of a random vector is a classical problem. When the variances of the components are unknown, various statistics constructed from the sample correlation matrices are often used. In the literature, the limiting distributions of these statistics have been well-studied in both low and high dimensional cases. In this talk, we will discuss a rather general extension of this independence test problem, in high dimensional case. We consider the independence test for $k$ subvectors of a random vector with dimension $p$, where the dimension of the subvector $p_i$'s can vary from 1 to order $p$. When the population covariance matrices of the subvectors are unknown, we construct a

random matrix model called (sample) block correlation matrix, based on $n$ samples. It turns out that the spectral statistics of the block correlation matrix do not depend on the unknown population covariance. Further, under the null hypothesis, the limiting behavior of the spectral statistics can be described with the aid of the free probability theory. Specifically, under three different settings of possibly $n$-dependent $k$ and $p_i$'s, we show that the empirical spectral distribution of the block correlation matrix converges to the free Poisson binomial distribution, free Poisson distribution (Marchenko-Pastur law) and free Gaussian distribution (semicircle law), respectively. We then further derive the CLT for the linear spectral statistics of the block correlation matrix in these three cases. Our results are established under general distribution assumption on the random vector. It turns out that the CLT is universal and does not depend on the 4-th cumulants of the vector components, due to a self-normalizing effect of the correlation type matrices. This talk is based on a work joint with Jiang Hu, Xiaocong Xu, and Xiaozhuo Zhang.

## Spectral gap of dense random regular graphs

**Yukun He, 何煜坤**
*City University of Hong Kong*

**Abstract**: Let $\mathcal{A}$ be the adjacency matrix of a random $d$-regular graph on $N$ vertices, and we denote its eigenvalues by $\lambda_1 \geq \lambda_2 \cdots \geq \lambda_N$. For $N^{2/3} \ll d \leq N/2$, we prove optimal rigidity estimates of the extreme eigenvalues of $\mathcal{A}$, which in particular imply that

$$\max\{|\lambda_N|, \lambda_2\} < 2\sqrt{d-1}$$

with overwhelming probability. In the same regime of $d$, we also show that

$$N^{2/3}\left(\frac{\lambda_2 + d/N}{\sqrt{d(N-d)/N}} - 2\right) \xrightarrow{d} \mathrm{TW}_1\,,$$

where $\mathrm{TW}_1$ is the Tracy-Widom distribution for GOE; analogue results also hold for other non-trivial extreme eigenvalues.

## Universality for the rightmost eigenvalue of non-Hermitian random matrices

**Yuanyuan Xu, 许媛媛**
*Institute of Science and Technology Austria*

**Abstract**: We will report some recent progress on the universality for the extreme eigenvalue of a large random matrix with i.i.d. entries. Beyond the radius of the celebrated circular law, we will establish a precise three-term asymptotic expansion for the rightmost eigenvalue with an optimal estimate on the error term. Based on this result, we will further show that the properly normalized rightmost eigenvalue will converge to a Gumbel distribution, as the dimension goes to infinity. Similar results will also hold true for the spectral radius of the matrix. Based on several joint works with Giorgio Cipolloni , László Erdős, and Dominik Schröder.

# IS 23: 随机偏微分方程

## Stochastic heat equations on moving domains

**Wei Wang, 王炜**
*University of Science and Technology of China*

**Abstract**: In this talk, we present the well-posedness of stochastic heat equations on moving domains, which amounts to a study of infinite dimensional interacting systems. The main difficulty is to deal with the problem caused by the time-varying state space and the interaction of the particle systems. The interaction still occurs even in the case of additive noise. This is in contrast to stochastic heat equations in a fixed domain.

## Quadratic transportation cost inequalities for stochastic reaction diffusion equations driven by space-time white noise

**Shijie Shang, 尚世界**
*University of Science and Technology of China*

**Abstract**: This talk concerns quadratic transportation cost inequalities for solutions of stochastic reaction diffusion equations driven by multiplicative space-time white noise, both on bounded and unbounded domains. Specially, on the unbounded domain R, the inequalities are proved under a weighted $L^2$-norm and a weighted uniform metric in the so called $L^2_{tem}$, $C_{tem}$ spaces. The new moments estimates of the stochastic convolution with respect to space-time white noise play an important role.

## Large and Moderate Deviation Principles for McKean-Vlasov SDEs with Jumps

**Wei Liu, 刘伟**
*Wuhan University*

**Abstract**: In this talk, we consider McKean-Vlasov stochastic differential equations (MVSDEs) driven by Lévy noise. By identifying the right equations satisfied by the solutions of the MVSDEs with shifted driving Lévy noise, we build up a framework to fully apply the weak convergence method to establish large and moderate deviation principles for MVSDEs. With this approach, we obtain large and moderate deviation principles for much wider classes of MVSDEs in comparison with the existing literature. This talk is based on a joint work with Yulin Song, Jianliang Zhai and Tusheng Zhang.

## Large deviations principle via Malliavin calculus for the Navier-Stokes system driven by a degenerate white-in-time noise

**Xuhui Peng, 彭旭辉**
*Hunan Normal University*

**Abstract**: We establish the Donsker-Varadhan type large deviations principle (LDP) for the two-dimensional stochastic Navier-Stokes system. The main novelty is that the noise is assumed to be highly degenerate in the Fourier space. The proof is carried out by using the existing criterion for the Donsker-Varadhan type large deviations principle. One of the main conditions of that criterion is the uniform Feller property for the Feynman-Kac semigroup, which we verify by using Malliavin calculus. This work is based on a joint work with Vahagn Nersesyan and Lihu Xu.

# IS 24: 连续状态分枝过程及相关模型

## Exponential ergodicity of affine processes

**Peng Jin, 金鹏**
*BNU-HKBU United International College*

**Abstract**: Affine processes are Markov processes for which the logarithm of the characteristic function of its transition distribution $P_t(x,\cdot)$ is affine with respect to the initial state $x$. Affine processes have found a wide range of applications in finance, due to their computational tractability and modeling flexibility. Many popular models in finance, such as the models of Cox et al., Heston and Vasicek, are of affine type. In this talk I will present our recent results on exponential ergodicity of affine processes under the total variation distance, which, in particular, can be applied to a large class of continuous-state branching processes with immigration. This talk is based on joint works with Martin Friesen, Jonas Kremer and Barbara Rüdiger.

## Mutually interacting superprocesses with migration

**Lina Ji, 季丽娜**
*Shenzhen MSU-BIT University*

**Abstract**: A system of mutually interacting superprocesses with migration is constructed as the limit of a sequence of branching particle systems arising from population models. The uniqueness in law of the superprocesses is established using the pathwise uniqueness of a system of stochastic partial differential equations, which is satisfied by the corresponding system of distribution-function-valued processes. This talk is based on a joint work with Huili Liu and Jie Xiong.

## Quasi-stationary distribution for the banching process with competition

**Pei-Sen Li, 李培森**
*Beijing Institute of Technology*

**Abstract**: We consider the continuous-state branching process with competition introduced in Berestycki, Fittipaldi and Fontbona (Probab. Theory Relat. Fields, 2018). We establish the strong Feller property and irreducibility for the process. These properties allow us to obtain a sufficient condition for the uniqueness and existence of the quasi-stationary distribution. This is a joint work with Jian Wang and Xiaowen Zhou.

## Stationarity and ergodicity for Affine processes

**Chunhua Ma, 马春华**
*Nankai University*

**Abstract**: The affine Markov processes introduced by Duffie et al. (2003) have been used widely in the financial world. In this talk, we give a necessary and sufficient condition guaranteeing that the limiting distribution exists. Then we turn to a two dimensional affine process for simplicity. Its ergodicity in the total variation can be derived via a thorough analysis of the large jumps and the coupling method inspired by Wang (2011).

# IS 25: 随机过程与随机分析在非对称信息市场中的应用

## Strategic trading with disagree to disagreement: Can the informational heterogeneity still matter?

**Deqing Zhou, 周德清**
*Central University of Finance and Economics*

**Abstract**: A dynamic trading framework is built for consensus-biased insiders who observe heterogeneous private signals but mistakenly regard them as homogeneous. A prominent result is that they would exploit most of their information advantage quickly in early stages, absent of the "waiting game effect" in Foster and Viswanathan (1996) and analogous to the pattern when insiders are actually homogeneously informed. Moreover, consensus bias can soften the competition and enhance insider profit when trading opportunities are scare.

## Insider Trading with Government Intervention in Financial Markets

**Zhihua Li, 李志华**
*Northeast Normal University*

**Abstract**: This paper studies an insider trading model with government intervention aiming to stabilize price volatility, in one-period, two-period, and multi-period scenarios. In a single-period model, we identify a threshold for the strength of government intervention that determines the interplay among market characteristics contingent on whether this threshold is exceeded or not. Furthermore, we find that government intervention effectively stabilizes price fluctuation in the multi-period model. By analyzing the association between market characteristics and intervention strength, we offer valuable insights for policymakers to stabilize financial markets. Our results illuminate the potential consequences of intervention and underscore its critical role during crisis and tension periods. Meanwhile, if there is one insider, the insider adopts alternating increasing trading strategies(V-shaped), while the government adopts corresponding hedging strategies. Besides, if there is more than one insider, the insider's trading intensity increases rapidly in the later periods; conversely, the government's trading intensity first increases and then decreases over time.

## On the equilibrium of insider trading under information acquisition with long memory

**Jixiu Qiu, 邱吉秀**
*Guizhou Normal University*

**Abstract**: In this paper, we study a general model of insider trading with a random deadline, in which an insider has some information acquisition on a risky asset at cost and noise traders trade with a process of stochastic volatility, both types of agents trading with some memory of their corresponding histories described by some kinds of fractional Brownian motions (FBMs) with Hurst parameters in $(\frac{1}{2}, 1)$ respectively. With semimartingales approximating to FBMs, a closed form of market equilibrium consisting of instantaneous precision, linear trading rate and semi-strong pricing rule is obtained; and by product, a market equilibrium when the insider possesses the complete information on the asset before trading is also given. It shows that in the equilibrium, the price process converges almost surely to the fundamental value of the risky asset as time goes to infinite, and market depth is a semimartingale while not a martingale. As Hurst parameters both in insider's information flow and noise trades tend to $\frac{1}{2}$, our results can converge to those respectively when both the insider and noise traders have no

memory. Finally, some simulations are given to illustrate how informational efficiency, price informativeness or market liquidity vary with trading time, insider's cost, Hurst parameters or approximate factors of both noise traders' memory and insider's memory.

## Optimal control of LQ problem with anticipative partial observations

**Jize Li, 李继泽**
*Guizhou Normal University*

**Abstract**: A stochastic LQ problem with anticipative (i.e. not adapted) partial observations is studied. With the help of enlargement of filtration, we turn the anticipative system into a higher dimensional and non-anticipative (i.e. adapted) one, and obtain the linear filtering equation of the latter by martingale representation theorem and an related equivalent control problem. Then by introducing a Riccati equation and an ordinary differential equation, we obtain a unique feedback optimal control of an equivalent control problem with full observations of the filtering equation. Finally, we derive the optimal value function for the original anticipative LQ problem, which is represented by the filtering of the extended adapted system and some modified coefficients.

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# IS 26: Recent advances of probability and statistics for machine learning

## Doubly inhomogeneous reinforcement learning

**Chengchun Shi, 史成春**
*London School of Economics and Political Science*

**Abstract**: This paper studies reinforcement learning (RL) in doubly inhomogeneous environments under temporal non-stationarity and subject heterogeneity. In a number of applications, it is commonplace to encounter datasets generated by system dynamics that may change over time and population, challenging high-quality sequential decision making. Nonetheless, most existing RL solutions require either temporal stationarity or subject homogeneity, which would result in sub-optimal policies if both assumptions were violated. To address both challenges simultaneously, we propose an original algorithm to determine the "best data chunks" that display similar dynamics over time and across individuals for policy learning, which alternates between most recent change point detection and cluster identification. Our method is general, and works with a wide range of clustering and change point detection algorithms. It is multiply robust in the sense that it takes multiple initial estimators as input and only requires one of them to be consistent. Moreover, by borrowing information over time and population, it allows us to detect weaker signals and has better convergence properties when compared to applying the clustering algorithm per time or the change point detection algorithm per subject. Empirically, we demonstrate the usefulness of our method through extensive simulations and a real data application.

## Deep PDE's solvers: error analysis and adaptive scheme

**Yuling Jiao, 焦雨领**
*Wuhan University*

**Abstract**: The use of deep learning methods for solving high-dimensional partial differential equations (PDEs) has gained significant attention recently. In the first part of this talk, I

will present some theoretical analysis from the perspective of deep non-parametric estimation for the main deep solvers in the literature, namely DRMs, PINNs and WANs. In the second part of the talk, I will introduce a novel method called Gaussian Mixture Distribution-based Adaptive Sampling (GAS) for PINNs, which aims to boost their accuracy. To demonstrate the effectiveness of the GAS method, we conduct several numerical simulations on 2D to 10D problems. The results show that GAS is a promising method for enhancing the accuracy of deep solvers and making them comparable with traditional numerical solvers.

## Enhancing Spaced Repetition Scheduling through Memory Dynamics Modelling and Stochastic Optimization

**Jingyong Su, 苏敬勇**
*Harbin Institute of Technology at Shenzhen*

**Abstract**: In this talk, I will discuss our published work, which emphasizes advancements in spaced repetition - a mnemonic technique optimizing memorization by scheduling review tasks. We developed an interpretable memory model with Markov property utilizing 220 million memory behavior logs from students, introducing an innovative framework for spaced repetition that cohesively unites memory prediction and schedule optimization. Our system captures memory dynamics and transforms the scheduling optimization into a stochastic shortest path problem, which is then solved via the value iteration method. Experimental results demonstrate substantial improvements: a 64% reduction in error, and a 17% cost reduction in recall rates prediction and schedule optimization. Our proposed system, deployed in the MaiMemo language-learning application, is presently assisting millions of Chinese students. We also constructed and publicly released the first benchmark dataset for spaced repetition, containing invaluable time-series data. The presentation will shed light on the theoretical foundation and methodology of our work.

## Proximal Causal Learning of Conditional Average Treatment Effects

**Yifan Cui, 崔逸凡**
*Zhejiang University*

**Abstract**: Efficiently and flexibly estimating treatment effect heterogeneity is an important task in a wide variety of settings ranging from medicine to marketing, and there are a considerable number of promising conditional average treatment effect estimators currently available. These, however, typically rely on the assumption that the measured covariates are enough to justify conditional exchangeability. We propose the P-learner, motivated by the R- and DR-learner, a tailored two-stage loss function for learning heterogeneous treatment effects in settings where exchangeability given observed covariates is an implausible assumption, and we wish to rely on proxy variables for causal inference. Our proposed estimator can be implemented by off-the-shelf loss-minimizing machine learning methods, which in the case of kernel regression satisfies an oracle bound on the estimated error as long as the nuisance components are estimated reasonably well.

# IS 27: 随机分析及其应用

## Risk-sensitive average Markov decision processes in general spaces

**Xian Chen, 陈娴**
*Xiamen University*

**Abstract**: We study discrete-time Markov decision processes with Borel state and action spaces under the risk-sensitive average cost criterion. The cost function can be unbounded. We introduce a new operator and prove the quasi-compactness of the operator from which the multiplicative Poisson equation is derived. Moreover, we develop a new approach to show the existence of a solution to the risk-sensitive average cost optimality equation and obtain the existence of an optimal deterministic stationary policy. Furthermore, we give two examples to illustrate our results. This is a joint work with Qingda Wei.

## McKean-Vlasov Stochastic Partial Differential Equations: Existence, Uniqueness and Propagation of Chaos

**Wei Hong, 洪伟**
*Jiangsu Normal University*

**Abstract**: In this work, we provide a general framework for dealing with McKean-Vlasov stochastic partial differential equations. We first show the existence of weak solutions by combining the localizing approximation, Faedo-Galerkin technique, stochastic compactness method and the Jakubowski version of the Skorokhod representation theorem. Then under certain locally monotone conditions we further investigate the existence and uniqueness of (probabilistically) strong solutions. The applications of the main results include a large class of McKean-Vlasov stochastic partial differential equations such as stochastic 2D/3D Navier-Stokes equations, stochastic Cahn-Hilliard equations. Finally, we show a propagation of chaos result in Wasserstein distance for weakly interacting stochastic 2D Navier-Stokes systems where the interaction term allows the *Stokes drag force* to be proportional to the relative velocity of the particles. This is a joint work with Shihu Li and Wei Liu.

## The Poisson Equation and Application to Multi-Scale SDEs with State-Dependent Switching

**Xiaobin Sun, 孙晓斌**
*Jiangsu Normal University*

**Abstract**: In this talk, we first present some recent results on the asymptotic behavior of multi-scale stochastic differential equations. Secondly, we focus on the Poisson equation associated with a Markov chain. By investigating the regularity of the Poisson equation solution, we obtain the optimal strong convergence order for a class of multi-scale stochastic differential equations with state-dependent switching. Finally, we also discuss some further works in this topic. This is a joint work with Professor Yingchao Xie.

## Transition Density Function Expansion Methods for Portfolio Optimization

**Qing Zhou, 周清**
*Beijing University of Posts and Telecommunications*

**Abstract**: In this talk, we propose new methods for stochastic control problems of utility maximization by the expansion of the transition density function without the restriction

on various forms of asset price models and utility functions. Based on Bellman's dynamic programming principle, we first rewrite the conditional expectation through the transition density function of the diffusion process whose closed-form expression is unavailable in most cases. Then, we use the methods of It?-Taylor expansion and Delta expansion to the transition density function of the multivariate diffusion process by quasi-Lamperti transformation in order to obtain the clear recursive expressions of expansion coefficient functions. We provide explicit algorithms generated from the backward recursive formulas of the value function and the optimal strategies by discretization methods. The convergence of the approximate approaches for stochastic control problems is demonstrated theoretically and practically. We illustrate the effectiveness and accuracy of our methods in portfolio selection problems of several classic models.

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## IS 28: 延迟随机系统控制与积分方程

### Maximum principle for stochastic optimal control problems with general delays

**Feng Zhang, 张峰**

*Shandong University of Finance and Economics*

**Abstract**: In this talk, we establish a sufficient maximum principle for one kind of stochastic optimal control problem with three types of delays (a discrete delay, a distributed delay and a noisy memory) when the control domain is convex. The main features of this research include the introduction of a unified adjoint equation and a simple method to get the adjoint process. One kind of optimal consumption problem and its special cases are studied as illustrative examples, for which the adjoint equations are solved with two different approaches and the optimal consumption strategies are obtained.

### A general maximum principle for optimal control of stochastic differential delay systems

**Weijun Meng, 孟维君**

*Academy of Mathematics and Systems Science, CAS*

**Abstract**: In this paper, we solve an open problem and obtain a general maximum principle for a stochastic optimal control problem where the control domain is an arbitrary non-empty set and all the coefficients (especially the diffusion term and the terminal cost) contain the control and state delay. In order to overcome the difficulty of dealing with the cross term of state and its delay in the variational inequality, we propose a new method: transform a delayed variational equation into a Volterra integral equation without delay, and introduce novel first-order, second-order adjoint equations via the backward stochastic Volterra integral equation theory. Finally we express these two kinds of adjoint equations in more compact anticipated backward stochastic differential equation types for several special yet typical control systems. This talk is based on a joint work with Prof. Jingtao Shi, Prof. Tianxiao Wang and Prof. Jifeng Zhang.

## BSDEs and BSVIEs with Anticipating Generators

**Hanxiao Wang, 王寒霄**
*Shenzhen University*

**Abstract**: For a backward stochastic differential equation (BSDE, for short), when the generator is not progressively measurable, it might not admit adapted solutions, shown by an example. However, for backward stochastic Volterra integral equations (BSVIEs, for short), the generators are allowed to be anticipating. This gives, among other things, an essential difference between BSDEs and BSVIEs. Under some proper conditions, the well-posedness of such BSVIEs is established. Further, the results are extended to path-dependent BSVIEs, in which the generators can depend on the future paths of unknown processes. An additional finding is that for path-dependent BSVIEs, in general, the situation of anticipating generators is not avoidable, and the adaptedness condition similar to that imposed for anticipated BSDEs by Peng and Yang [*Anticipated backward stochastic differential equations, Ann. Probab.*, 37 (2009), pp. 877–902] is not necessary. Joint work with Jiongmin Yong and Chao Zhou.

## Maximum principle for optimal control of stochastic evolution equations with recursive utilities

**Guomin Liu, 刘国民**
*Nankai University*

**Abstract**: We consider the optimal control problem of stochastic evolution equations in a Hilbert space under a recursive utility, which is described as the solution of a backward stochastic differential equation (BSDE). A very general maximum principle is given for the optimal control, allowing the control domain not to be convex and the generator of the BSDE to vary with the second unknown variable $z$. The associated second-order adjoint process is characterized as a unique solution of a conditionally expected operator-valued backward stochastic integral equation. This talk is based on a joint work with Prof. Shanjian Tang.