



The 19th Workshop on Markov Processes and Related Topics

福州

2024年7月22-26日

Sponsors:

Key Laboratory of Mathematics and Complex Systems of Ministry of Education, School of Mathematical Sciences, Beijing Normal University
School of Mathematics and Statistics, Fujian Normal University

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School of Mathematics and Statistics & Key Laboratory of Analytical Mathematics and Applications (Ministry of Education) & Fujian Provincial Key Laboratory of Statistics and Artificial Intelligence, Fujian Normal University

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If you have any questions about accommodation or transportation issues, please contact us

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<http://math0.bnu.edu.cn/probab/Workshop2024/>

Chair:

Mu-Fa Chen

Organization

Committee:

Dayue Chen

Zenghu Li

Yong-Hua Mao

Jian Wang

Feng-Yu Wang

Xianping Guo

Yingchao Xie

Xicheng Zhang

Local

Organizer:

Huonan Lin

Jian Wang

Lu-Jing Huang

Shukai Chen

Rongjuan Fang

Bingyao Wu

历史文化名城——福州

福州，别称榕城，简称“榕”，是福建省省会，位于福建省东部、闽江下游及沿海地区，现辖5区2县级市6县，全市陆地总面积11968平方公里，其中市区面积1786平方公里，全市海域总面积11.09万平方公里，海岸线长1137公里。截至2022年末，福州市常住人口844.8万人。习近平总书记曾深情地说：“福州是有福之州，福州人是有福之人”。

福州是海峡西岸经济区的政治、经济、文化、科研中心以及现代金融服务业中心，是首批14个对外开放的沿海港口城市之一，海上丝绸之路门户以及中国（福建）自由贸易试验区三片区之一；福州也是近代中国最早开放的五个通商口岸之一，福州马尾是中国近代海军的摇篮，中国船政文化的发祥地；曾获“综合实力五十强城市”“中国优秀旅游城市”“国家卫生城市”“国家园林城市”“全国环保模范城市”“全国双拥模范城市”“国家历史文化名城”“全国文明城市”“全国宜居城市”“福布斯中国大陆最佳商业城市百强城市”等称号。第一届全国青年运动会曾于2015年10月在福州成功举办。

福州历史悠久、文化底蕴深厚。福州建城于公元前202年，是国家历史文化名城，拥有昙石山、船政、三坊七巷、寿山石等4大文化名片。三坊七巷被评为十大“中国历史文化名街”之一，从这里走出了林则徐、沈葆楨、严复等一批历史名人。福州的学校教育始于西晋，初兴于唐，从北宋至南宋进入全盛时代，官办的府学、县学普遍建立，私人讲学书院大量涌现，各乡里都有书社。自隋朝至清朝末期，共举行502次进士科考试，产生502个状元，其中50个是福建人，其中福州府十邑十个县之人（宋代初期到明代后期是十一个县，包括明代后期并回候官县的怀安县）占了22个。科举资料记载，福州府十邑十个县“举进士者二千二百四十七人”，全国闻名。南宋学者吕祖谦的一首诗生动地描绘了当时福州文化教育的昌盛：“路逢十客九青衿，半是同胞旧弟兄，最忆市桥灯火静，巷南巷北读书声”。

福州经济繁荣、综合实力较强。全市地区生产总值，2020年达10020亿元，增长5.1%；今年一季度达2238亿元，增长18%。已形成1个三千亿产业集群（纺织化纤）、1个两千亿产业集群（轻工食品）、3个一千亿产业集群（机械制造、电子信息、冶金建材），成为中国东南沿海产业集聚程度、配套能力较高的城市之一。

福州交通便利、区位优势明显。地处中国东南沿海，面对台湾，邻近港澳，与东南亚联系紧密。目前，已形成海陆空三位一体、多层次、多功能的交通网络体系。高速公路基本形成以福州为中心、覆盖全省的“四小时通达网”，长乐国际机场已开通国内外航线119条，与国内外93个城市通航。

福州近台侨多、开放程度较高。福州是祖国大陆距离台湾最近的省会城市，黄岐半岛距马祖岛不到8000米，福州籍台湾乡亲有80多万人，台湾每个县（市）都设有福州同乡会。同时，福州也是著名侨乡，福州籍海外乡亲达400多万人，分布在世界177个国家和地区。

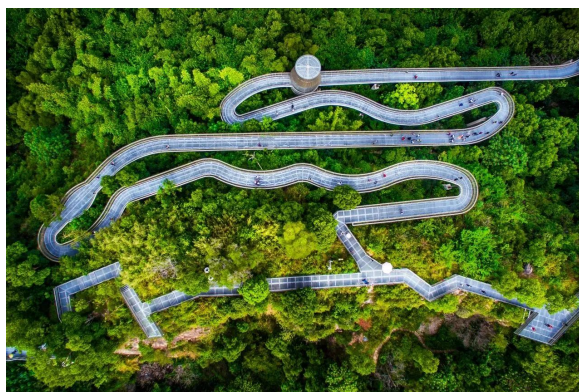
福州山清水秀、生态环境良好。福州是中国最“绿”的城市之一，森林覆盖率为58.36%，位居全国省会城市第2位；福州也是中国空气质量最好的城市之一，空气质量在全国168个重点城市中排名第8位。

福州政策叠加、发展机遇难得。先后被国家赋予福州新区、海丝核心区、自贸试验区、生态文明试验区、自主创新示范区、海洋经济发展示范区等“多区叠加”的政策资源。近年来，陆续出台扶持民营经济措施36条、惠及台胞台企措施74条、系列惠企政策84条，形成了一套比较完整的扶持实体经济发展的政策体系。

福州景点



三坊七巷



福道

福州美食



福州肉燕



福州鱼丸

福建师范大学简介

福建师范大学坐落于素有“海滨邹鲁”之誉的历史文化名城福州，是一所历史悠久、声誉斐然的百年省属高等学府。学校肇始于1907年清朝帝师陈宝琛先生创办的“福建优级师范学堂”，后由华南女子文理学院、福建协和大学、福建省立师范专科学校等单位几经调整合并，于1953年成立福建师范学院，1972年易名为福建师范大学并沿用至今。福建师范大学是福建省人民政府与教育部共建高校、福建省重点建设的高水平大学、福建省一流大学建设高校、福建省第二轮“双一流”建设A类高校。

学校本部共有旗山、仓山两个校区，占地面积4000多亩。现有本科专业84个（2023年全日制普通本科招生专业78个），全日制普通本科学学生2.5万余人，各类研究生1万余人。学校充分发挥学科龙头带动作用，着力构建一流文科、高水平理科、有特色工科的学科体系，基本形成了综合性大学的学科布局。拥有国家重点学科1个、福建省第二轮“双一流”建设主干学科3个、省高峰学科9个和高原学科13个，博士后科研流动站20个，博士学位授权一级学科19个，博士专业学位授权点3个，硕士学位授权一级学科32个，硕士专业学位类别26个。化学、工程学、材料科学、计算机科学、环境科学与生态学、农学、社会科学总论、植物与动物学8个学科进入ESI全球排名前1%，其中5个学科进入ESI前5%。

叶圣陶、郭绍虞、董作宾、林兰英、郑作新、黄维垣、唐仲璋、唐崇惕、姚建年等诸多蜚声海内外的大师巨匠曾在学校任教。经过一代又一代福建师大人的传承创新，学校砥砺出“知行笃行，立诚致广”的校训精神，孕育了“重教、勤学、求实、创新”的优良校风，着力推动各项事业不断向前发展，荣获“全国文明单位”“全国文明校园”等一大批高级别荣誉称号。建校以来，学校向社会培养输送各级各类人才近60万名，为国家和福建经济社会发展作出了突出贡献。

走过117年光荣历程的福建师范大学，不忘立德树人初心，牢记为党育人、为国育才使命，全面深化综合改革，全面推进内涵发展，全面提高办学质量，正朝着加快建成富有鲜明特色的综合性全国一流大学的奋斗目标大踏步前进，努力为谱写全面建设社会主义现代化国家福建篇章、实现中华民族伟大复兴的中国梦作出新的更大贡献。

福建师范大学数学与统计学院简介

福建师范大学数学与统计学院肇始于1907年陈宝琛先生创办的“福建优级师范学堂”的数学科。后由华南女子文理学院、福建协和大学、福建省立师范专科学校等院校几经调整合并，于1953年成立福建师范学院，保留和发展了数学系。1972年，改名为福建师范大学数学系。1996年，成立计算机科学系，与数学系合称为福建师范大学数学系、计算机科学系。2002年，成立数学与计算机科学学院。2017年6月，数学与计算机科学学院、软件学院整合成立数学与信息学院。2021年6月，数学与信息学院分设数学与统计学院、计算机与网络空间安全学院（软件学院）。

学院现设数学系和统计学系，拥有数学与应用数学（师范类）、统计学、数据科学3个本科专业，现有在读学生1622人，其中研究生398人、本科生1224人。数学与应用数学专业是国家级特色专业、入选国家级一流本科专业建设点、通过教育部师范类专业二级认证；统计学专业入选国家级一流本科专业建设点。近年来，学院获得国家级教学成果二等奖4项，福建省教学成果奖特等奖1项、一等奖2项。学院教师担任人民教育出版社中学数学教材的主编工作。获批国家级一流课程3门、省级一流课程4门，国家级资源共享课程1门，省级教育教学改革项目5项（重点项目1项、一般项目4项），省级人才培养模式创新实验区1个，省级研究生教育创新基地1个。

现有，数学、统计学2个一级学科博士学位授权点，数学、统计学2个博士后科研流动站，数学、统计学2个一级学科硕士学位授权点，学科教学（数学）、应用统计2个专业学位硕士点。数学是福建省高峰学科，统计学是福建省重点学科。现有分析数学及应用教育部重点实验室、福建省分析数学及应用重点实验室、统计学与人工智能福建省高校重点实验室、福建省应用数学中心、福建师范大学数学研究中心和福建数学基础教育研究中心等科研平台。学院自1958年以来，主办《福建中学数学》杂志。学院还是福建省中小学数学学科教学带头人培养基地。

近年来，学院主动融入国家战略和地方经济社会发展，强化有组织的科研。学院教师获国家自然科学基金等国家级项目30多项；其中，国家自然科学基金杰出青年项目1项、国家自然科学基金优秀青年项目1项、国家自然科学基金重点项目3项（含参加）；获教育部自然科学奖一等奖1项、福建省自然科学奖一等奖、二等奖、三等奖各1项以及福建省社会科学奖二等奖1项、三等奖1项。学院学生在全国大学生数学竞赛、全国大学生数学建模竞赛、全国高校师范生教学技能大赛等高水平赛事中取得优异成绩。

学院高度重视高层次人才队伍建设，学院现有在职教职工117人，其中教授28人，副教授46人，博士生导师16人；其中，长江学者特聘教授1人，国家杰出青年科学基金获得者2人，国家优秀青年科学基金获得者1人，国务院政府特殊津贴2人，闽江学

者7人，入选福建省“百人计划”2人，福建省“雏鹰计划”青年拔尖人才2人，福建省“百千万人才工程”3人，福建省优秀教师1人，福建省“运盛”青年科技奖2人，建有“随机分析及相关领域”福建省高校科技创新团队、“非线性分析及应用”福建省博士生导师团队。2024年学院获批国家留学基金委创新型人才国际合作培养项目。

学院已为党和国家培养了许多优秀的人才，他们积极工作，奋发向上，成为各行业的骨干，为教育发展、经济建设和社会进步做出了重要的贡献。江文哉、张远南、王毓泉、李必成、刘金星、林风、林群、叶青柏、林顺来、郑一平、李迅、林燎、邵东生、徐明杰、周灵、黄金德、赵祥枝、王奇南、林亚南、李海北等校友荣获“福建省杰出人民教师”荣誉称号。广大校友爱国爱校，慷慨解囊，捐资助学。2006年，福建师范大学数学系61级学生、香港知名企业家、福建师范大学客座教授吴维新先生捐资设立“吴维新教育基金”；2015年，吴维新先生再次捐资设立“吴维新研究生奖学金”。

学院党委认真履行党建工作主体责任，汇聚人心，凝聚力量，推动学院各项工作不断取得新的成绩。学院党委被福建省委教育工委评为“福建省学校创先争优先进基层党组织”、1个学生党支部被福建省委教育工委评为“先进基层党组织”。学院工会被中华全国总工会评为“模范职工小家”、被福建省总工会评为“五一先锋号”。学院团委获得“全国五四红旗团委创建单位”“福建省新长征突击手”“福建省五四红旗团委标兵”“福建省五四红旗团委”“福建省基层团建示范单位”等荣誉称号。学院教师还获得“福建青年五四奖章”“福建省优秀共青团干部”“福州市青年五四奖章”“校五一劳动奖章”等荣誉称号。

Sign In:

- **Qishan Meiyuan Hotel (旗山梅园酒店：闽侯上街镇国宾大道350号):**
No. 350, Guobin road, Minhou Shangjiezen

- **Traffic:**

You can get to Qishan Meiyuan Hotel from Fuzhou Changle International Airport (福州长乐机场) by Yuanxiang Airport Express or Taxi.

Yuanxiang Airport Express (元翔空港快线): Airport Express Changle Airport Station (空港快线长乐机场站)→Qishan Meiyuan Hotel Station (旗山梅园酒店站) . It takes about 90 minutes. PS. You can buy tickets at the ticket office of “Yuanxiang Airport Express Center” (元翔机场售票处) or book tickets online on the WeChat official account of ”Yuanxiang Airport Express” (元翔空港快线公众号).

Taxi (出租车): It takes about 60 minutes and costs about ¥210.

You can get to Qishan Meiyuan Hotel from FuZhou Railway Station (福州火车站) by Metro or Taxi.

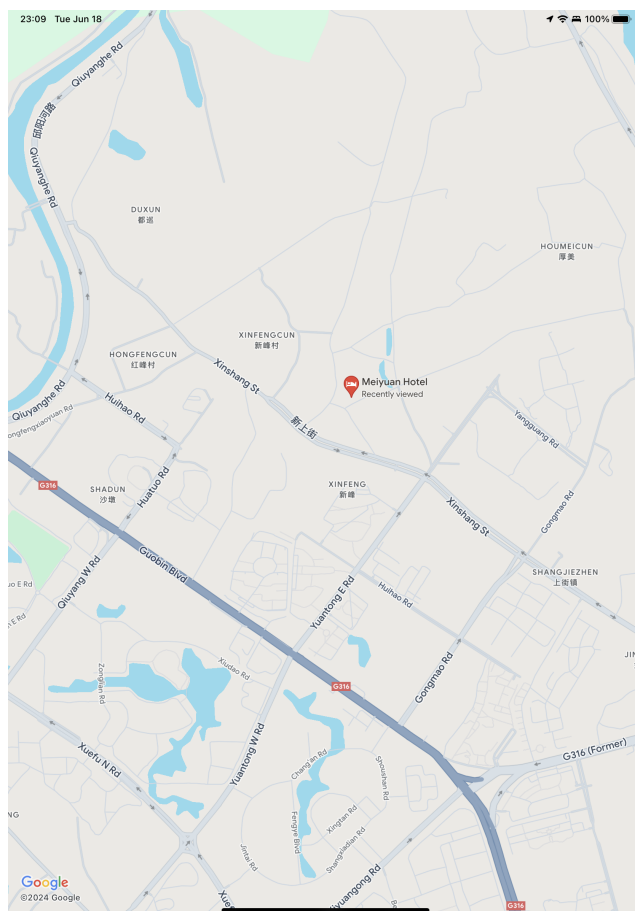
Metro (地铁): FuZhou Railway Station 福州火车站 → Nanmendou Station 南门兜站 (line 2) → Shangjie Station 上街站 → Hotel (by walking)

Taxi (出租车): It takes about 30 minutes and costs about ¥55.

You can get to Qishan Meiyuan Hotel from Fuzhounan Railway Station (福州南火车站) by Metro or Taxi.

Metro (地铁): Fuzhounan Railway Station 福州南火车站 → Jinshan Station 金山站 (line 2) → Shangjie Station 上街站→Hotel (by walking)

Taxi (出租车): It takes about 30 minutes and costs about ¥83.



Schedule - Session 1

Venue: (1) Morning of July 23: AB hall (AB 厅) on the 2nd floor in the hotel; (2) Other times: B hall (B 厅) on the 2nd floor in the hotel.

| Beijing Time (GMT+8) | July 23 (Tuesday) | July 24 (Wednesday) | July 25 (Thursday) | July 26 (Friday) |
|-------------------------|-----------------------------|------------------------------|----------------------------|----------------------------|
| Chairman | Jian Wang 王健 | Feng-Yu Wang 王凤雨 | Zhan Shi 施展 | Xianping Guo 郭先平 |
| 08:10-08:30 | OPENING | | | |
| 08:30-09:00 | Xia Chen 陈夏 | Tusheng Zhang 张土生 | Xiaowen Zhou 周晓文 | Yi Zhang 张宜 |
| 09:00-09:30 | Jingyu Huang 黄靖宇 | Guoli Zhou 周国立 | Yuki Chino 千野由喜 | Jieming Wang 王洁明 |
| 09:30-10:00 | Pu Fei 蒲飞 | Cheuk Yin Lee 李卓彦 | Mingyang Sun 孙明阳 | Ching-Wei Ho 何政衡 |
| | Tea break 茶歇 | | | |
| Chairman | Xia Chen 陈夏 | Tusheng Zhang 张土生 | Xiaowen Zhou 周晓文 | Yingchao Xie 谢颖超 |
| 10:30-11:00 | Chenggui Yuan 袁成桂 | Jianliang Zhai 翟建梁 | Hui He 何辉 | Fuqing Gao 高付清 |
| 11:00-11:30 | Juan Li 李娟 | Xuhui Peng 彭旭辉 | Quan Shi 石权 | Weina Wu 武伟娜 |
| 11:30-12:00 | Zherui Fan 范哲睿 | Ran Wang 王冉 | Hui Xiao 肖惠 | Xiaobin Sun 孙晓斌 |
| | Lunch 午餐 | | | |
| Chairman | Chenggui Yuan 袁成桂 | Jianliang Zhai 翟建梁 | Yuanyuan Liu 刘源远 | |
| 14:00-14:30 | Yuanyuan Liu 刘源远 | Yaozhong Hu 胡耀忠 | Yanqi Qiu 邱彦奇 | |
| 14:30-15:00 | Bo Wu 吴波 | Xiangdong Li 李向东 | Tianyi Bai 白天衣 | |
| 15:00-15:30 | Lijuan Cheng 程丽娟 | Bingyao Wu 吴炳耀 | Rui Zhang 张蕊 | |
| | Tea break 茶歇 | | | |
| Chairman | Huonan Lin 林火南 | Yaozhong Hu 胡耀忠 | Hui He 何辉 | |
| 16:00-16:30 | Dong Yao 姚东 | Xu Yang 杨叙 | Xinxin Chen 陈昕昕 | |
| 16:30-17:00 | Jiangping Jian 姜建平 | Peisen Li 李培森 | Huaming Wang 王华明 | |
| 17:00-17:30 | Junyu Zhang 张骏玉 | Shukai Chen 陈舒凯 | Xiaoyue Zhang 张小玥 | |
| 18:00 | Banquet | Dinner 晚餐 | | |

All Lunch and Dinner (including Banquet) will be held on Huayuan Yanhui Hall on the first floor (一层花园宴会厅)

There are Posters during Tea break.

Schedule - Session 2

Venue: C hall (C 厅) on the 2nd floor in the hotel.

| Beijing Time (GMT+8) | July 23 (Tuesday) | July 24 (Wednesday) | July 25 (Thursday) | July 26 (Friday) |
|-------------------------|--------------------------|-----------------------------|---------------------------|----------------------------|
| Chairman | | Zhenghu Li 李增沪 | Zhao Dong 董昭 | Yong-Hua Mao 毛永华 |
| 08:10-08:30 | | | | |
| 08:30-09:00 | | Junyi Guo 郭军义 | Jing Wu 巫静 | Deli Li 李德立 |
| 09:00-09:30 | | Lijun Bo 薄立军 | Xing Huang 黄兴 | Lung-Chi Chen 陈隆奇 |
| 09:30-10:00 | | Ming Zhou 周明 | Mengyu Cheng 程梦雨 | Michael Choi 蔡卓轩 |
| | Tea break 茶歇 | | | |
| Chairman | | Junyi Guo 郭军义 | Fuqing Gao 高付清 | |
| 10:30-11:00 | | Chao Zhu 朱超 | Xianyuan Wu 吴宪远 | |
| 11:00-11:30 | | Qingda Wei 魏清达 | Xuyan Xiang 向绪言 | |
| 11:30-12:00 | | Wei Xu 徐伟 | Xiaoyue Li 李晓月 | |
| | Lunch 午餐 | | | |
| Chairman | Dayue Chen 陈大岳 | Xicheng Zhang 张希承 | Xianyuan Wu 吴宪远 | |
| 14:00-14:30 | Fubao Xi 席福宝 | Yongsheng Song 宋永生 | Liming Wu 吴黎明 | |
| 14:30-15:00 | Jianhai Bao 鲍建海 | Xiliang Fan 范锡良 | Wei Liu 刘伟 | |
| 15:00-15:30 | Deng Zhang 张登 | Zimo Hao 郝子墨 | Tao Wang 王涛 | |
| | Tea break 茶歇 | | | |
| Chairman | Fubao Xi 席福宝 | Yong Liu 刘勇 | Liming Wu 吴黎明 | |
| 16:00-16:30 | Yong Liu 刘勇 | Yulin Song 宋玉林 | Xin Chen 陈昕 | |
| 16:30-17:00 | Zigeng Xia 夏梓耕 | Panpan Ren 任盼盼 | Panki Kim | |
| 17:00-17:30 | Bin Tang 唐斌 | Xiaolong Zhang 张晓龙 | Kyung-Youn Kim 金璟允 | |
| 18:00 | Banquet | Dinner 晚餐 | | |

All Lunch and Dinner (including Banquet) will be held on Huayuan Yanhui Hall on the first floor (一层花园宴会厅)

There are Posters during Tea break.

July 23 (Tuesday)

Session 1

Chairman: Jian Wang

08:10-08:30 *Opening and Taking photos*

Chairman: Jian Wang

08:30-09:00 Xia Chen (University of Tennessee, USA)

Hyperbolic Anderson equations with general time-independent Gaussian noise: Stratonovich regime

09:00-09:30 Jingyu Huang (University of Birmingham, UK)

Stochastic heat equation with super-linear drift and multiplicative noise on R^d

09:30-10:00 Fei Pu (Beijing Normal University)

Lower bound on spatial asymptotic of parabolic Anderson model with narrow wedge initial condition

Chairman: Xia Chen

10:30-11:00 Chenggui Yuan (Swansea University, UK)

Long Time Propagation of Chaos for mean-field SDEs

11:00-11:30 Juan Li (Shandong University)

Path-dependent controlled Mean-Field coupled forward-backward SDEs. The associated stochastic maximum principle

11:30-12:00 Zherui Fan (Peking University)

Polynomial lower bound on the effective resistance for the one-dimensional critical long-range percolation

Chairman: Chenggui Yuan

14:00-14:30 Yuanyuan Liu (Central South University)

Ergodic control of singularly perturbed Markov processes with a general state space

14:30-15:00 Bo Wu (Fudan University)

Functional inequalities on Gaussian path spaces

15:00-15:30 Lijuan Cheng (Hangzhou Normal University)

Probability Versions of Li-Yau Type Inequalities and Applications

Chairman: Huonan Lin

16:00-16:30 Dong Yao (Jiangsu Normal University)

Pólya urns with graph-based interactions

16:30-17:00 Jianping Jiang (Tsinghua University)

Particle masses in the near-critical Ising model

17:00-17:30 Junyu Zhang (Sun Yat-sun University)

Nonstationary discounted decentralized stochastic games under prospect theory with applications to the smart grid

July 23 (Tuesday)

Session 2

Chairman: Dayue Chen

14:00-14:30 Fubao Xi (Beijing Institute of Technology)

Successful couplings for switching diffusion systems with past-dependent switching

14:30-15:00 Jianhai Bao (Tianjin University)

Exponential contractivity of modified EM schemes for SDEs with partial dissipativity

15:00-15:30 Deng Zhang (Shanghai Jiao Tong University)

Multi solitary waves to stochastic nonlinear Schroedinger equations

Chairman: Fubao Xi

16:00-16:30 Yong Liu (Peking University)

Some new results on (complex) wiener-itô integrals

16:30-17:00 Zigeng Xia (Peking University)

The interpretability of deep neural networks based on renormalization group

17:00-17:30 Bin Tang (Peking University)

The asymptotic behaviors for super-Brownian motion with absorption

July 24 (Wednesday)

Session 1

Chairman: Feng-Yu Wang

08:30-09:00 Tusheng Zhang (University of Science and Technology of China)

Metastability of Random Dynamical Systems

09:00-09:30 Guoli Zhou (Chongqing University)

Global existence and uniqueness of pathwise solution to the stochastic 3D inviscid Burgers equations

09:30-10:00 Cheuk Yin Lee (The Chinese University of Hong Kong)

Local times of anisotropic Gaussian random fields and stochastic heat equation

Chairman: Tusheng Zhang

10:30-11:00 Jianliang Zhai (University of Science and Technology of China)

Some Recent Progress in Stochastic Partial Differential Equations Driven by Pure Jump Levy Noise

11:00-11:30 Xuhui Peng (Hunan Normal University)

Ergodicity for 2D Navier-Stokes equations with a degenerate pure jump noise

11:30-12:00 Ran Wang (Wuhan University)

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

Chairman: Jianliang Zhai

14:00-14:30 Yaozhong Hu (University of Alberta)

Convergence to Gamma density of some functionals of Gaussian processes

14:30-15:00 Xiangdong Li (University of Chinese Academy of Sciences, Beijing)

Curvature-dimension condition, entropy differential inequalities and rigidity theorems

15:00-15:30 Bingyao Wu (Fujian Normal University)

Wasserstein Convergence Rates for Empirical Measures of Random Subsequence of $\{n\alpha\}$

Chairman: Yaozhong Hu

16:00-16:30 Xu Yang (North Minzu University)

The extinction behavior for a stochastic lotka–volterra type population system with competition

16:30-17:00 Peisen Li (Beijing Institute of Technology)

Scaling limits and phase transitions of a fragmentation-coalescence process

17:00-17:30 Shukai Chen (Fujian Normal University)

Exponential ergodicity of cbire-processes with competition and catastrophes

July 24 (Wednesday)

Session 2

Chairman: Zenghu Li

08:30-09:00 Junyi Guo (Nankai University)

Monotone mean-variance criterion and its application in risk theory

09:00-09:30 Lijun Bo (University of Science and Technology of China)

Optimal Inventory Control with State Dependent Jumps

09:30-10:00 Ming Zhou (Renmin University of China)

Optimal Consumption-Leisure-Investment and Retirement Choices with Non-Concave Aspirational Utility

Chairman: Junyi Guo

10:30-11:00 Chao Zhu (University of Wisconsin-Milwaukee, USA)

Optimal Harvesting Problems with Mean Field Interactions

11:00-11:30 Qingda Wei (Huaqiao University)

Nonzero-Sum Discrete-Time Constrained Stochastic Games

11:30-12:00 Wei Xu (Beijing Institute of Technology)

Limit Theorems of Hawkes Processes and Stochastic Volterra Equations

Chairman: Xicheng Zhang

14:00-14:30 Yongsheng Song (Academy of Mathematics and Systems Science, Chinese Academy of Sciences)

The strong law of large numbers and ergodicity under sublinear expectations

14:30-15:00 Xiliang Fan (Anhui Normal University)

Distribution dependent bsdes driven by gaussian processes

15:00-15:30 Zimo Hao (Bielefeld University)

Singular kinetic McKean-Vlasov SDEs

Chairman: Yong Liu

16:00-16:30 Yulin Song (Nanjing University)

Regularities of Distribution Dependent SDEs

16:30-17:00 Panpan Ren (City University of Hong Kong)

Extrinsic Derivative Formula for Distribution Dependent SDEs

17:00-17:30 Xiaolong Zhang (Beijing Institute of Technology)

\mathcal{W}_p -convergence rate of Euler-Maruyama schemes for SDEs driven by supercritical α -stable processes

July 25 (Wednesday)

Session 1

Chairman: Zhan Shi

08:30-09:00 Xiaowen Zhou (Concordia University)

Speeds of coming down from infinity for Λ -Fleming-Viot supports

09:00-09:30 Yuki Chino (National Yang Ming Chiao Tung University)

Random walk in cooling random environment

09:30-10:00 Mingyang Sun (Beijing Normal University)

Conditional limits for critical branching random walks in a varying environment

Chairman: Xiaowen Zhou

10:30-11:00 Hui He (Beijing Normal University)

Brownian CRTs conditioned to be large

11:00-11:30 Quan Shi (Academy of Mathematics and Systems Science, Chinese Academy of Sciences)

Time-changed Levy processes starting from infinity

11:30-12:00 Hui Xiao (Academy of Mathematics and Systems Science, Chinese Academy of Sciences)

Conditioned random walks on linear groups: construction of the target harmonic measure

Chairman: Yuanyuan Liu

14:00-14:30 Yanqi Qiu (Hangzhou Institute for Advanced Study, UCAS)

Harmonic analysis of Mandelbrot Cascades

14:30-15:00 Tianyi Bai (Academy of Mathematics and Systems Science, Chinese Academy of Sciences)

Intersection equivalence for sum of fractal percolations

15:00-15:30 Rui Zhang (Capital Normal University)

On properties of the limits of Biggins' martingales of the branching Levy processes

Chairman: Hui He

16:00-16:30 Xinxin Chen (Beijing Normal University)

Precise large deviation of level sets of branching Brownian motion

16:30-17:00 Huaming Wang (Anhui Normal University)

Times of a branching process with immigration in varying environments attaining fixed levels

17:00-17:30 Xiaoyue Zhang (Capital University of Economics and Business)

Minimal position of branching random walks in random environment: critical case

July 25 (Wednesday)

Session 2

Chairman: Zhao Dong

08:30-09:00 Jing Wu (Sun Yat-sen University)

On McKean-Vlasov stochastic variational inequalities with irregular coefficients

09:00-09:30 Xing Huang (Tianjin University)

Log-Harnack Inequality and Bismut Formula for McKean-Vlasov SDEs with Singularities in all Variables

09:30-10:00 Mengyu Cheng (Beijing Institute of Technology)

The averaging principle for sde with singular drift

Chairman: Fuqing Gao

10:30-11:00 Xianyuan Wu (Capital Normal University)

Double jump in the maximum of two-type reducible branching Brownian motion

11:00-11:30 Xuyan Xiang (North Minzu University)

On the regularization of reaction-diffusion equations by the Wright-Fisher white noise

11:30-12:00 Xiaoyue Li (Tiangong University)

Exponential ergodicity of generalized branching processes

Chairman: Xianyuan Wu

14:00-14:30 Liming Wu (UCA and HIT)

Harmonic analysis of Mandelbrot Cascades

14:30-15:00 Wei Liu (Wuhan University)

Intersection equivalence for sum of fractal percolations

15:00-15:30 Tao Wang (Jiangsu Normal University)

On properties of the limits of Biggins' martingales of the branching Levy processes

Chairman: Liming Wu

16:00-16:30 Xin Chen (Shanghai Jiao Tong University)

Quenched local limit theorem for random conductance models with long-range jumps

16:30-17:00 Panki Kim (Seoul National University, Korea)

Markov processes with jump kernels decaying at the boundary

17:00-17:30 Kyung-Youn Kim (National Chung Hsing University, Taiwan)

Heat kernel estimates for non-local operator with singular jump in $C^{1,1}$ open set

July 26 (Thursday)

Session 1

Chairman: Xianping Guo

08:30-09:00 Yi Zhang (University of Birmingham , UK)

Periodic measures and Wasserstein distance for analysing periodicity of time series datasets

09:00-09:30 Jieming Wang (Beijing Institute of Technology)

Multi solitary waves to stochastic nonlinear Schroedinger equations

09:30-10:00 Ching-Wei Ho (Institute of Mathematics, Academia Sinica)

Poisson approximation for the level sets of parabolic Anderson model

Chairman: Yingchao Xie

10:30-11:00 Fuqing Gao (Wuhan University)

On Some Ergodic Impulse Control Problems with Applications

11:00-11:30 Weina Wu (Nanjing University of Finance and Economics)

A stochastic control problem arising from relaxed wealth tracking with a monotone benchmark process

11:30-12:00 Xiaobin Sun (Jiangsu Normal University)

Risk-sensitive average Markov decision processes in general spaces

July 26 (Thursday)

Session 2

Chairman: Yong-Hua Mao

08:30-09:00 Deli Li (Lakehead University, Canada)

Mean-field super-Brownian motion

09:00-09:30 Lung-Chi Chen (National Chengchi University)

Long time behaviors of mean field interacting particle systems and McKean-Vlasov equations

09:30-10:00 Michael Choi (National University of Singapore)

Mean square exponential stability of numerical methods for stochastic differential delay equations

Intersection equivalence for sum of fractal percolations

Tianyi BAI *The Hong Kong University of Science and Technology*,
E-mail: tianyi.bai73@amss.ac.cn

Abstract: Recently, hitting probability of a distant set for the sum of independent simple random walks has been achieved in [1]. Combining it with the equivalence of random walk and fractal percolation in [2], we obtain a similar property on the sum of fractal percolations. This talk is based on joint work with Xinxin Chen and Yuval Peres.

References:

- [1] A. Asselah, I. Okada, B. Schapira, & P. Sousi (2023). Branching random walks and Minkowski sum of random walks, *arXiv:2308.12948*.
- [2] Y. Peres (1996). Intersection-equivalence of Brownian paths and certain branching processes. *Commun. Math. Phys.*, **177**(2), 417-434.

Exponential contractivity of modified EM schemes for SDEs with partial dissipativity

Jianhai BAO *Tianjin University, China*, E-mail: jianhaibao@tju.edu.cn

Abstract: In this talk, we propose a modified Euler-Maruyama (EM for short), which might incorporate the classical EM scheme, the tamed EM scheme, the truncated EM scheme, to name a few. Regarding the proposed EM scheme, based on the coupling approach, we establish exponential contractivity under different probability distances for SDEs, where the drifts under consideration are merely dissipative in the long distance.

Optimal inventory control with state dependent jumps

Lijun BO *University of Science and Technology of China, China*, E-mail: lijunbo@ustc.edu.cn

Abstract: We study an optimal inventory control problem under a reflected jump-diffusion netflow process with state dependent jumps, in which the intensity of the jump process can depend on the inventory space level. We handle the well-posedness of the associated integro-differential HJB (ID-HJB) equation with Neumann boundary condition in classical sense. To achieve it, we first establish the existence of viscosity solutions to the ID-HJB equation of an auxiliary control problem with a compact policy space, which is proved to be equivalent to the primal problem. We reformulate the ID-HJB equation as a Neumann HJB equation with the (non-local) integral term in terms of the value function of the auxiliary problem and prove a unique classical solution to the Neumann HJB equation. Then, the well-posedness of primal ID-HJB equation can follow together from the unique classical solution of Neumann HJB equation and the existence of viscosity solutions to the auxiliary ID-HJB equation. Based on this classical solution, we characterize the optimal (admissible) inventory control strategy and prove the verification result of the primal control problem.

Asymptotic behavior of a generalized independent sets model on the two-dimensional Sierpinski gasket

Lung-Chi CHEN *National Chengchi University, Taipei*, E-mail: lcchen@nccu.edu.tw

Abstract: In this talk, we consider a generalized independent sets model on the two-dimensional Sierpinski gasket SG_n . Let \mathcal{A} be a set of symbol and given a subset $\mathcal{S} \subset \mathcal{A}$. Let $p \in (0, 1)$ be the probability of each vertex of SG_n with a symbol in \mathcal{S} , and $1 - p$ the probability of each vertex with a symbol not in \mathcal{S} , under the condition that the symbols of nearest-neighbor vertices are not allowed to be the forbidden blocks $\mathcal{F} = \{ij : i, j \in \mathcal{S}\}$. When $\mathcal{A} = \{0, 1\}$, $\mathcal{S} = \{0\}$ and $p = 1/2$, this reduces to independent set model or golden mean shift in symbolic dynamics. I present the asymptotic behavior of this generalized model on the two-dimensional Sierpinski gasket and obtain upper and lower bounds of the entropy per site for $p \in (0, 1)$. This is a joint work with Shu-Chiuan Chang (National Cheng Kung University).

Exponential ergodicity of cbire-processes with competition and catastrophes

Shukai CHEN *Fujian Normal University, China*, E-mail: skchen@fjnu.edu.cn

Abstract: We establish the exponential ergodic property in a weighted total variation distance of continuous-state branching processes with immigration in random environments with competition and catastrophes, under a Lyapunov-type condition and other mild assumptions. The proof is based on a Markov coupling process along with some delicate estimates for the associated coupling generator. In particular, the main result indicates whether and how the competition mechanism, the environment and the catastrophe could balance the branching mechanism respectively to guarantee the exponential ergodicity of the process. This is based on a joint work with Fang Rongjuan, Ji Lina and Wang jian.

Hyperbolic Anderson equations with general time-independent Gaussian noise: Stratonovich regime.

Xia CHEN *University of Tennessee, USA*, E-mail: xchen3@tennessee.edu

Abstract: In this paper, we investigate the hyperbolic Anderson equation generated by a time-independent Gaussian noise with two objectives: The solvability and intermittency. First, we prove that Dalang's condition is necessary and sufficient for existence of the solution. Second, we establish the precise long time and high moment asymptotics for the solution under the usual homogeneity assumption of the covariance of the Gaussian noise. Our approach is fundamentally different from the ones existing in literature. The main contributions in our approach include the representation of Stratonovich moment under Laplace transform via the moments of the Brownian motions in Gaussian potentials and some large deviation skills developed in dealing effectively with the Stratonovich chaos expansion.

Quenched local limit theorem for random conductance models with long-range jumps

Xin CHEN *Shanghai Jiao Tong University, China*, E-mail: chenxin217@sjtu.edu.cn

Abstract: We establish the quenched local limit theorem for reversible random walk on Z^d (with $d \geq 2$) among stationary ergodic random conductances that permit jumps of arbitrary length. The

proof is based on the weak parabolic Harnack inequalities and on-diagonal heat-kernel estimates for long-range random walks on general ergodic environments. As a byproduct, we prove the maximal inequality with an extra tail term for long-range reversible random walks, which in turn yields the everywhere sublinear property for the associated corrector. This talk is based on joint work with Takashi Kumagai and Jian Wang.

Precise large deviation of level sets of branching Brownian motion

Xinxin CHEN *Beijing Normal University, China*, E-mail: xinxin.chen@bnu.edu.cn

Abstract: We consider a continuous-time branching Brownian motion (BBM) on the real line which spreads with speed $\sqrt{2}$. Its x -level set counts the number of particles located above xt at time t . The typical behavior of x -level set for $0 < x < \sqrt{2}$ is known by Biggins [2] and Glenz et al [3]. We study the precise large deviation of level sets, which improves the previous result of Aïdékon et al[1]. We also discuss the behaviors of BBM conditioned on large x -level set. This is based on joint works with L. de Raphélis and Heng Ma.

References

- [1] E. Aïdékon, Yueyun Hu and Zhan Shi (2019). Large deviations for level sets of a branching Brownian motion and Gaussian free fields, *J. Math. Sci.*, New York **238**(4), 348-365.
 - [2] J. D. Biggins (1992). Uniform Convergence of Martingales in the Branching Random Walk, *Ann. Probab.*, **20**(1), 137-151.
 - [3] G. Glenz, N. Kistler and M. Schmidt (2018). High points of branching Brownian motion and McKean's Martingale in the Bovier-Hartung extremal process, *ECP*, **23**, 1-12.
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Probability versions of Li-Yau type inequalities and applications

Lijuan CHENG *Hangzhou Normal University, China*, E-mail: 20220006@hznu.edu.cn

Abstract: By using stochastic analysis, two probability versions of Li-Yau type inequalities are established for diffusion semigroups on a manifold possibly with a (non-convex) boundary, under the Bakry-Emery curvature-dimension condition as well as the lower bound condition of the second fundamental form if the boundary exists. As applications, a number of global and local estimates are presented, which extend or improve the corresponding ones derived in the literature for manifolds without boundary.

The averaging principle for SDE with singular drift

Mengyu CHENG *Beijing Institute of Technology, China*, E-mail: mengyu.cheng@hotmail.com

Abstract: Averaging principle is an effective method for investigating dynamical systems with highly oscillating components. In this talk, we establish the averaging principle for SDEs with singular drift. Precisely, using Zvonkin’s transformation and the Schauder estimate, we prove that the solutions of the original system strongly and weakly converge to the solution of the averaged system as the time scale ε goes to zero.

Random walk in cooling random environment

Yuki CHINO *National Yang Ming Chiao Tung University*, E-mail: y.chino.leiden@gmail.com

Abstract: We considered random walk in cooling random environment (RWCRE) in this talk. The model is one of the RWRE models with dynamics and is expected to interpolate between the classical and dynamical model. In other words, if we tune the cooling speed sufficiently fast, the model becomes close to the static model and vice versa. Mainly we are interested in the affection from the environment, that is, how introducing dynamics to random environment changes the trapping effect. We published a series of papers exploring questions on SLLN, LDP, fluctuations and recurrence vs transience. We first proved robustness of SLLN and LDP for RWCRE. In the second one, we investigate how the recurrence versus transience criterion known for RWRE changes for RWCRE and proved that transience is stable for the effective cooling regime. However we showed that recurrent is more delicate for the speed of cooling. We also considered the fluctuations for RWCRE when RWRE is either recurrent or satisfies a classical central limit theorem. In the recurrent case we found a crossover between the static behaviour and homogeneous behaviour with respect to the speed of cooling. We also gave the mechanism of this crossover in a sharper sense. In the Gaussian regime, we show that the classical CLT and the stability of the variance. We also put a conjecture that also in the transience regime there will be a crossover with respect to the cooling speed.

This talk is based on joint work with L. Avena (University of Florence), C. da Costa (Duhram University) and F. den Hollander (Leiden University).

[1] L. Avena, Y. Chino, C. da Costa and F. den Hollander.
Random walk in cooling random environment: ergodic limits and concentration inequalities.
Electronic Journal of Probability. **24** (2019): 1–35

[2] L. Avena, Y. Chino, C. da Costa and F. den Hollander.
Random walk in cooling random environment: recurrence versus transience and mixed fluctuations.
Annales de l’Institut Henri Poincaré, Probabilités et Statistiques **58** (2022): 967–1009.

A rate-distortion framework for MCMC algorithms: geometry and factorization of multivariate Markov chains

Michael C.H. CHOI *National University of Singapore, Singapore*, E-mail: mchchoi@nus.edu.sg

Abstract: We introduce a framework rooted in a rate distortion problem for Markov chains, and show how a suite of commonly used Markov Chain Monte Carlo (MCMC) algorithms are specific instances within it, where the target stationary distribution is controlled by the distortion function. Our approach offers a unified variational view on the optimality of algorithms such as Metropolis-Hastings, Glauber dynamics, the swapping algorithm and Feynman-Kac path models. Along the way, we analyze factorizability and geometry of multivariate Markov chains. Specifically, we demonstrate that induced chains on factors of a product space can be regarded as information projections

with respect to a particular divergence. This perspective yields Han–Shearer type inequalities for Markov chains as well as applications in the context of large deviations and mixing time comparison.

Distribution dependent SDEs with fractional noises

Xiliang FAN *Anhui Normal University, China*, E-mail: fanxiliang0515@163.com

Abstract: In this talk, I will report the recent results on distribution dependent SDEs driven by fractional Brownian motions with Hurst parameter $H \in (0, 1/2) \cup (1/2, 1)$, which include the well-posedness, Bismut formulas for the Lions derivative, asymptotic behaviors (large deviation principle, moderate deviation principle, central limit theorem) and log-Harnack inequalities.

Polynomial lower bound on the effective resistance for the one-dimensional critical long-range percolation

Zherui FAN *Peking University, China*, E-mail: 2301110064@pku.edu.cn

Abstract: In this work, we study the critical long-range percolation on Z , where an edge connects i and j independently with probability $1 - \exp\{-\beta|i - j|^{-2}\}$ for some fixed $\beta > 0$. Viewing this as a random electric network where each edge has a unit conductance, we show that with high probability the effective resistances from the origin 0 to $[-N, N]^c$ and from the interval $[-N, N]$ to $[-2N, 2N]^c$ (conditioned on no edge joining $[-N, N]$ and $[-2N, 2N]^c$) both have a polynomial lower bound in N . Our bound holds for all $\beta > 0$ and thus rules out a potential phase transition (around $\beta = 1$) which seemed to be a reasonable possibility. This talk is based on a joint work with Jian Ding and Lujing Huang.

Fluctuations and moderate deviations for a binary collision model

Fuqing GAO *Wuhan University, China*, E-mail: fqgao@whu.edu.cn

Abstract: We study fluctuations and moderate deviations for a discrete energy Kac-like walk associated with Boltzmann-type equations. We show that the empirical fluctuation field of the model converges in law to an infinite dimensional OU process. The large deviation principle corresponding to the fluctuation is also established.

Monotone mean-variance criterion and its application in risk theory

Junyi GUO *Nankai University, China*, E-mail: jyguo@nankai.edu.cn

Abstract: In this paper, an optimization problem for the monotone mean-variance(MMV) criterion is considered in the perspective of the insurance company. With this criterion we study the optimal investment and reinsurance problem which is formulated as a zero-sum game between the insurance company and an imaginary player. We apply the dynamic programming principle and solve the corresponding HJBI equation to get the optimal strategy and the value function. Moreover, the MMV efficient frontier is also given and a numerical example is presented.

Singular kinetic McKean-Vlasov SDEs

Zimo HAO *Bielefeld University, Germany*, E-mail: zhao@math.uni-bielefeld.de

Abstract: In this talk, we delve into mean-field kinetic stochastic differential equations (SDEs) featuring Gaussian environment noise and singular interaction kernels driven by Brownian motion and α -stable processes. First, we develop paracontrolled calculus within the kinetic framework when the driving noise is Brownian motion. Applying this, we establish global well-posedness for nonlinear singular kinetic equations with both singular environment noise and bounded interaction kernel, contingent upon the well-definition of the products of singular terms. We obtain how such products can be defined in scenarios where the singular term is a Gaussian random field. Second, when the driving noise takes an α -stable process, we give the well-posedness and provide quantitative estimates for the propagation of chaos related to the kinetic SDEs endowed with singular interaction kernels, such as the Coulomb potential, and devoid of environment noise (The talk is based on joint works with Jean-Francois Jabir, Stephane Menozzi, Michael Röckner, Xicheng Zhang, Rongchan Zhu and Xiangchan Zhu).

Brownian CRTs conditioned to be large

Hui HE *Beijing Normal University, China*, E-mail: hehui@bnu.edu.cn

Abstract: We consider a Feller diffusion $(Z_s, s \geq 0)$ (with diffusion coefficient $\sqrt{2\beta}$ and drift $\theta = 0$) that we condition on $\{Z_t = a_t\}$, where a_t is a deterministic function, and we study the limit in distribution of the conditioned process and of its genealogical tree as $t \rightarrow +\infty$. When a_t does not increase too rapidly, we obtain the standard size-biased process (and the associated genealogical tree given by the Kesten's tree). When a_t behaves as $\alpha\beta^2 t^2$, we obtain a new process whose distribution is described by a Girsanov transformation and equivalently by a SDE with a Poissonian immigration (depending on α). Its associated genealogical tree is described by an infinite discrete skeleton (which does not satisfy the branching property) decorated with Brownian continuum random trees given by a Poisson point measure. At last if the time is permitted, we shall show how to recover above results from a Gibbs' viewpoint. This talk is based on joint works with Romain Abraham, Jean-François Delmas and Meltem Ünel.

Heat flow on random polynomials

Ching-Wei HO *Institute of Mathematics, Academia Sinica*, E-mail: chwho@gate.sinica.edu.tw

Abstract: It is a classical problem to study the evolution of roots of polynomials under application of a differential operator. In this talk, I will discuss the heat evolution of random polynomials with

a rotationally invariant root distribution on the complex plane. The limiting root distribution of the heat-evolved random polynomial can be completely determined in terms of its log potential. For example, when a Weyl polynomial, whose root distribution converges to the uniform distribution on the unit disk, undergoes heat flow, the limiting root distribution is uniform on some ellipse until time 1 at which it becomes exactly the semicircle law. This is joint work with Brian Hall, Jonas Jalowy, and Zakhar Kabluchko.

Convergence to Gamma density of some functionals of Gaussian processes

Yaozhong HU *University of Alberta, Canada*, E-mail: y.hu@ualberta.ca

Abstract: We establish the convergence of the densities of a sequence of nonlinear functionals of an underlying Gaussian process to the density of a Gamma distribution. We provide precise estimates on the distance between densities while developing the techniques of Malliavin calculus and Stein's method suitable to Gamma approximation. We first focus our study on the case of random variables living in a fixed Wiener chaos of an even order for which the bound for the difference of the densities can be dominated by a linear combination of moments up to order four. We then study the case of general Gaussian functionals with possibly infinite chaos expansion. Finally, we provide two applications of our results, namely the limit of random variables living in the second Wiener chaos, and the limit of sums of independent Pareto distributed random variables. This is a joint work with Solesne Bourguin and Thanh Dang.

Stochastic heat equation with super-linear drift and multiplicative noise on R^d .

Jingyu HUANG *University of Birmingham, UK*, E-mail: j.huang.4@bham.ac.uk

Abstract: Consider the stochastic heat equation on R^d ,

$$\frac{\partial u}{\partial t} = \frac{1}{2} \Delta u + b(u) + \sigma(u) \dot{W}, \quad (1)$$

where \dot{W} is a centered Gaussian noise which is white in time and colored in space, the initial condition is assumed to be a function with sufficient decay. The functions $b(z)$ and $\sigma(z)$ are locally Lipschitz and as $|z| \rightarrow \infty$, $b(z)$ and $\sigma(z)$ may grow faster than linear functions. We show that under improved Dalang's condition of the noise and Osgood type conditions of b and σ , there is a unique global solution. This is based on joint work with Le Chen, Mohammud Foondun and Mickey Salins.

Log-Harnack inequality and bismut formula for McKean-Vlasov SDEs with singularities in all variables

Xing HUANG *Tianjin University, China*, E-mail: xinghuang@tju.edu.cn

Abstract: The log-Harnack inequality and Bismut formula are established for McKean-Vlasov SDEs with singularities in all (time, space, distribution) variables, where the drift satisfies a standard

integrability condition in time-space, and may be discontinuous in the distance induced by any Dini function. The main results considerably improve the existing ones for the case where the drift is L -differentiable and Lipschitz continuous in distribution with respect to the quadratic Wasserstein distance.

Particle masses in the near-critical Ising model

Jianping JIANG *Tsinghua University, China*, E-mail: jianpingjiang@tsinghua.edu.cn

Abstract: Consider the scaling limit of the magnetization field in the near-critical planar Ising model. We are interested in particle masses in the associated relativistic quantum field theory. We will report our recent progress on the claim that the mass spectrum measure has an atom at the endpoint of the first mass gap. Based on ongoing work with Frederik Klausen.

Heat kernel estimates for non-local operator with singular jump in $C^{1,1}$ open set

Kyung-Youn KIM *National Chung Hsing Univeristy, Taiwan*, E-mail: kykim@nchu.edu.tw

Abstract: We discuss heat kernel bounds for non-local operators with singular kernels. We consider anisotropic Markov processes $Z := (Z^1, \dots, Z^d)$ where each coordinate Z^i is i.i.d. 1-dimensional symmetric process. It has a jump kernel comparable to that of various order described by a weak scaling function. We obtain heat kernel estimates on $C^{1,1}$ -open set $D \subset \mathbb{R}^d$, and discuss Green function estimates as its application. This is the joint work with Lidan Wang.

Markov processes with jump kernels decaying at the boundary

Panki KIM *Seoul National University, South Korea*, E-mail: pkim@snu.ac.kr

Abstract: In this talk, we discuss pure-jump Markov processes on smooth open sets whose jumping kernels vanishing at the boundary and part processes obtained by killing at the boundary or (and) by killing via the killing potential. The killing potential may be subcritical or critical. This work can be viewed as developing a general theory for non-local singular operators whose kernel vanishing at the boundary. Due to the possible degeneracy at the boundary, such operators are, in a certain sense, not uniformly elliptic. These operators cover the restricted, censored and spectral Laplacians in smooth open sets and much more. The main results are the boundary Harnack principle and its possible failure, and sharp two-sided Green function estimates. This is a joint work with Soobin Cho (University of Illinois, USA), Renming Song (University of Illinois, USA) and Zoran Vondraček (University of Zagreb, Croatia)

Local times of anisotropic Gaussian random fields and stochastic heat equation

Cheuk Yin LEE *The Chinese University of Hong Kong*, E-mail: leecheukyin@cuhk.edu.cn

Abstract: We study the local times of a large class of Gaussian random fields satisfying strong local nondeterminism with respect to an anisotropic metric. We establish moment estimates and Holder conditions for the local times of the Gaussian random fields. Our key estimates rely on geometric properties of Voronoi partitions with respect to an anisotropic metric and the use of Besicovitch's covering theorem. As a consequence, we deduce sample path properties of the Gaussian random fields that are related to Chung's law of the iterated logarithm and modulus of non-differentiability. Moreover, we apply our results to systems of stochastic heat equations with additive Gaussian noise and determine the exact Hausdorff measure function with respect to the parabolic metric for the level sets of the solutions. This is joint work with Yimin Xiao.

Divergence criteria for a class of random series related to the partial sums of I.I.D. random variables

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Abstract: Let $\{X, X_n; n \geq 1\}$ be a sequence of independent and identically distributed Banach space valued random variables. This work is devoted to providing a divergence criteria for a class of random series of the form $\sum_{n=1}^{\infty} f_n(\|S_n\|)$ where $S_n = \sum_{i=1}^n X_i$, $n \geq 1$ and $\{f_n(\cdot); n \geq 1\}$ is a sequence of nonnegative nondecreasing functions defined on $[0, \infty)$. More specifically, it is shown that (i) the above random series diverges almost surely if $\sum_{n=1}^{\infty} f_n(cn^{1/2}) = \infty$ for some $c > 0$ and (ii) the above random series converges almost surely if $\sum_{n=1}^{\infty} f_n(cn^{1/2}) < \infty$ for some $c > 0$ provided additional conditions are imposed involving X , the sequences $\{S_n; n \geq 1\}$ and $\{f_n(\cdot); n \geq 1\}$, and c . A special case of this criteria is a divergence/convergence criteria for the random series $\sum_{n=1}^{\infty} a_n \|S_n\|^q$ based on the series $\sum_{n=1}^{\infty} a_n n^{q/2}$ where $\{a_n; n \geq 1\}$ is a sequence of nonnegative numbers and $q > 0$.

This is a joint work with Professor Michael J. Klass at University of California Berkeley and Professor Andrew Rosalsky at University of Florida.

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Path-dependent controlled Mean-Field coupled forward-backward SDEs. The associated stochastic maximum principle

Juan LI *Shandong University, China*, E-mail: juanli@sdu.edu.cn

Abstract: In the present paper we discuss a new type of mean-field coupled forward-backward stochastic differential equations (MFFBSDEs). The novelty consists in the fact that the coefficients of both the forward as well as the backward SDEs depend not only on the controlled solution processes (X_t, Y_t, Z_t) at the current time t , but also on the law of the paths of (X, Y, u) of the solution process and the process by which it is controlled. The existence for such a MFFBSDE which is fully coupled through the law of the paths of (X, Y) in the coefficients of both the forward and the backward equations is proved under rather general assumptions. The main part of the work is devoted to the study of Pontryagin's maximal principle for such a MFFBSDE. The dependence of the coefficients of the law of the paths of the solution processes and their control makes that a completely new and interesting criterion for the optimality of a stochastic control for the MFFBSDE is obtained.

Furthermore, we show that this necessary optimality condition is, under the assumption of convexity of the Hamiltonian, also sufficient. The talk is based on joint work with Rainer Buckdahn (UBO, France), Junsong Li (SDU, China), Chuanzhi Xing (SDU, China)

Scaling limits and phase transitions of a fragmentation-coalescence process

Pei-Sen LI *Beijing Institute of Technology*, E-mail: peisenli@bit.edu.cn

Abstract: In this paper, we consider the block-counting process associated with a class of fragmentation-coalescence processes. In these processes, coagulations occur multiply and non-simultaneously, while the fragmentation mechanisms permit an individual block to split into either a finite or an infinite number of sub-blocks. We establish necessary and sufficient conditions for the block-counting process to explode or not, and to come down from infinity or not. It is proved that the scaling limit of the block-counting process is a solution to a stochastic differential equation with jumps. Furthermore, we develop an excursion theory for this solution, within which several interesting quantities are explicitly computed.

Curvature-dimension condition, entropy differential inequalities and rigidity theorems

Xiangdong LI *University of Chinese Academy of Sciences, Beijing*, E-mail: xdli@amt.ac.cn

Abstract: In our recent work, we prove the equivalence between the curvature-dimension condition and the corresponding entropy differential inequalities along the Benamou-Brenier geodesics on the Wasserstein space over Riemannian manifolds. We prove that the rigidity models of the entropy differential inequalities are the Einstein manifolds and the quasi-Einstein manifolds with Hessian solitons. Our work provides an information-theoretic approach to understand the synthetic geometry on metric measure spaces developed by Lott-Villani and Sturm. In this talk, I will present these results.

Numerical approximations for McKean-Vlasov stochastic differential equations in finite and infinite time

Xiaoyue LI *Northeast Normal University*, E-mail: lixy@tiangong.edu.cn

Abstract: In this talk we introduce the Euler-Maruyama (TEM) numerical method for the McKean-Vlasov stochastic differential equations (MV-SDEs) with super-linear growth drift and diffusion coefficients in the state variable. Based on the propagation of chaos in the L^q sense, we yield the 1/2-order optimal strong convergence rate of the TEM numerical solutions corresponding to the particle system using stopping time techniques. Furthermore, the TEM numerical solutions capture the long-term dynamical behaviors of MV-SDEs, including moment boundedness, stability, and ergodicity. Moreover, the numerical invariant probability measure approximates the underlying measure of MV-SDEs in the L^2 -Wasserstein distance.

The multi-valued McKean-Vlasov stochastic differential equations with jumps

Wei LIU *Wuhan University, China*, E-mail: wliu.math@whu.edu.cn

Abstract: In this talk, we first show the existence and uniqueness of strong solutions for multi-valued McKean-Vlasov stochastic differential equations with non-Lipschitz coefficients driven by Lévy noise. Then we establish the Freidlin-Wentzell type large and moderate deviation principles by the weak convergence method. These are joint works with Lingyan Cheng, Caihong Gu and Fengwu Zhu.

Some new results on (complex) Wiener-Itô integrals

Yong LIU *Peking University*, E-mail: liuyong@math.pku.edu.cn

Abstract: In this talk, we present some new theoretical results on (complex) Wiener-Itô integrals and their applications. We characterize the relation between the real and complex Wiener-Itô integrals. Given a complex multiple Wiener-Itô integral, we get explicit expressions for the kernels of its real and imaginary parts. Conversely, considering a two-dimensional real Wiener-Itô integrals, we obtain a representation formula by a finite sum of complex Wiener-Itô integral. Furthermore, we discuss the the rate of convergence in the normal approximation of (complex) Wiener-Itô integral.

This is a joint work with Huiping CHEN (Academy of Mathematics and Systems Science, CAS), Yong CHEN (Jiangxi Normal University).

Ergodic control of singularly perturbed Markov processes with a general state space

Yuanyuan LIU *Central South University*, E-mail: liuyy@csu.edu.cn

Abstract: In this talk, we report our recent results about the singular perturbation for discrete-time Markov chains with general state space, specially the presence of transient set is allowed. Using the idea of aggregation, we obtain the expansion expression for the invariant distribution and the fundamental operator regarding the perturbed transition kernel. Furthermore, we apply these expansion expressions to derive the Laurent series expansions for the mean passage time, and the asymptotic optimal policies for the long-run average cost and the discounted cost of the Markov decision process. Examples are shown to illustrate these results. The talk is based on the joint research work with Qingwei Jiang and Zhixin Wen.

Ergodicity for 2D Navier-Stokes equations with a degenerate pure jump noise

Xuhui PENG *Hunan Normal University, P.R.China*, E-mail: xhpeng@hunnu.edu.cn

Abstract: We establish the ergodicity for stochastic 2D Navier-Stokes equations driven by a highly degenerate pure jump Lévy noise. The noise could appear in as few as four directions. The case

of Gaussian noise was treated in Hairer and Mattingly [*Ann. of Math.*, 164(3):993–1032, 2006]. To obtain the uniqueness of invariant measure, we use Malliavin calculus and anticipating stochastic calculus to establish the equi-continuity of the semigroup, the so-called *e-property*, and prove some weak irreducibility of the solution process. This talk is based on a joint work with Jianliang Zhai and Tusheng Zhang.

Lower bound on spatial asymptotic of parabolic Anderson model with narrow wedge initial condition

Fei PU *Beijing Normal University*, E-mail: fei.pu@bnu.edu.cn

Abstract: Let $\{u(t, x) : (t, x) \in (0, \infty) \times \mathbb{R}\}$ be the solution to parabolic Anderson model with narrow wedge initial condition. Using the association property of parabolic Anderson model, we establish a lower bound on spatial asymptotic of the solution:

$$\liminf_{R \rightarrow \infty} \frac{\max_{|x| \leq R} \left(\log u(t, x) + \frac{x^2}{2t} \right)}{(\log R)^{2/3}} \geq \frac{1}{4} \left(\frac{t}{2} \right)^{1/3}, \quad \text{a.s.}$$

Harmonic analysis of Mandelbrot Cascades

Yanqi QIU *Hangzhou Institute for Advanced Study, UCAS*, E-mail: yanqi.qiu@hotmail.com

Abstract: We will talk about various perspective on the Fourier analysis on the random measure obtained from Mandelbrot cascades. In the general situation, we shall discuss a sufficient condition for the cascade operator to preserve the positive Fourier dimension. In the canonical case, we obtain the precise formula for the Fourier dimension of the cascade measure. This talk is based on joint work with Xinxin Chen, Yong Han and Zipeng Wang.

Extrinsic derivative formula for distribution dependent SDEs

Panpan REN *City University of Hong Kong*, E-mail: panparen@cityu.edu.hk

Abstract: To characterize the regularity of nonlinear Fokker-Planck equations with respect to weighted variational distances, we establish for the first time a Bismut type formula for the extrinsic derivative of distribution dependent SDEs (DDSDEs). As an application, the Lipschitz continuity in the weighted variational distance is derived for the associated nonlinear Fokker-Planck equation, which can be regarded as the counterpart of the classical contraction property in the linear setting. The main results are illustrated by non-degenerate DDSDEs with space-time singular drift, as well as degenerate DDSDEs with weakly monotone coefficients.

Time-changed Lévy processes starting from infinity

Quan SHI *Chinese Academy of Sciences*, E-mail: quan.shi@amss.ac.cn

Abstract: Starting Markov processes from boundary points of the state space has a long history, dating back all the way to William Feller. In this talk we present different ways to start time-changed Lévy processes from infinity, a question that has attracted a lot of interest in the past decade for instance in the study of self-similar Markov processes or branching processes with state-dependent immigration. Our main results give sharp conditions on the Lévy process and the time-change function to allow natural and regular entrance.

Joint work with Leif Döring (Mannheim) and Samuel Baguley (Postdam).

Regularities of distribution dependent SDEs

Yulin SONG *Nanjing University*, E-mail: ylsong@nju.edu.cn

Abstract: In this talk, we will talk about the regularities with respect to the initial value and coefficients of distribution-dependent SDEs driven by jumps processes or fractional Brownian motions. The main tool is Malliavin calculus for Wiener-Poisson functionals and Malliavin calculus for fractional Brownian motions.

The strong law of large numbers and ergodicity under sublinear expectations

Yongsheng SONG *Chinese Academy of Sciences*, E-mail: yssong@amss.ac.cn

Abstract: Peng (2007) proved the law of large numbers under sublinear expectations (LLN*) with convergence in distribution. After that, much literature was devoted to the strong version of LLN*, as well as ergodicity under sublinear expectations, in the sense of almost sure convergence.

In this talk, we first give a characterization of the continuous ergodic capacities, based on which we prove the ergodicity result that the time means are bounded by the upper and lower expectations. Then, we investigate under which conditions the upper and lower expectations can be obtained by the time means.

The continuity of the capacities is a rather restrictive assumption for LLN* and ergodicity. To get rid of this assumption, we give a version of strong LLN under regular sublinear expectations defined on a Polish space, which shows that any cylindrical random variables taking values in the mean interval can be considered as a limit of the empirical averages.

Time-dependent poisson equation and application to nonautonomous multi-Scale SDEs

Xiaobin SUN *Jiangsu Normal University, China*, E-mail: xbsun@jsnu.edu.cn

Abstract: Drawing from an investigation of the solution of Evolution system of measures for time-dependent stochastic differential equations, we establish the regularity for the corresponding time-dependent Poisson equation. As an application, we study the averaging principle for nonautonomous multi-scale stochastic differential equations.

Conditional limits for critical branching random walks in a varying environment

Mingyang SUN *University*, E-mail:

Abstract: In this talk, we consider a critical branching random walk that the offspring laws are varying in time. Let Z_n be the counting measure which counts the number of particles of n -th generation located in a given region. We establish some conditional limit theorems for the empirical distribution of Z_n and show that in this critical case the limiting distributions exhibit three different behaviors. This is a joint work with Professor Wenming Hong.

The mixing and dissipation enhancement by transport noise

Bin TANG *Peking University, Beijing*, E-mail: tangbin@math.pku.edu.cn

Abstract: We investigate the mixing properties of solutions to the stochastic transport equation $du = \circ dW \cdot \nabla u$, where the driving noise $W(t, x)$ is white in time, colored and divergence-free in space. Furthermore, we prove the dissipation enhancement in the presence of a small viscous term. Applying our results, we also derive the mixing properties for a regularized stochastic 2D Euler equation. This is a joint work with Dejun Luo and Guohuan Zhao.

Times of a branching process with immigration in varying environments attaining fixed levels

Huaming WANG *Anhui Normal University*, E-mail: huamingking@mail.bnu.edu.cn

Abstract: Consider a branching process $\{Z_n\}_{n \geq 0}$ with immigration in varying environments. Fix an integer $\ell > 0$ and let $a_k, k = 1, \dots, \ell$ be nonnegative integers. Set $T(a_1, \dots, a_\ell) = \{n \geq 0 : Z_{n+1} = a_1, \dots, Z_{n+\ell} = a_\ell\}$. We give a criterion to determine whether the set $T(a_1, \dots, a_\ell)$ is finite or not. Furthermore, for the critical Galton-Watson process with immigration, based on a moment method, we show that, when properly scaled, $|T(a_1, \dots, a_\ell) \cap [0, n]|$ converges in distribution to a random variable with the standard exponential distribution.

Dirichlet heat kernel estimates of subordinate diffusion processes with diffusive components in $C^{1,\alpha}$ open sets

Jie-Ming WANG *Beijing Institute of Technology, China*. E-mail: wangjm@bit.edu.cn

Abstract: In this paper, explicit sharp two-sided estimates of the Dirichlet heat kernels for a class of symmetric subordinate diffusion processes with diffusive components in $C^{1,\alpha}$ ($\alpha \in (0, 1]$) open sets in \mathbb{R}^d are derived when the scaling order of the Laplace exponent of purely discontinuous part of the subordinator is between 0 and 1 including 1. The main result of this paper shows the stability of Dirichlet heat kernel estimates for such processes in $C^{1,\alpha}$ open sets in the sense that the estimates depend on the divergence elliptic operator only via its uniform ellipticity constant and the Dini

continuity modulus of the diffusion coefficients. As a corollary, the sharp two-sided estimates for Green functions of those processes in bounded $C^{1,\alpha}$ open sets are obtained.

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

Ran WANG *Wuhan University*, E-mail: rwan@whu.edu.cn

Abstract: We consider a stochastic fractional heat equation driven by 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.

Eigenvalue criteria and Lyapunov function sequences for super Poincaré inequalities

Tao WANG *Jiangsu Normal University*, E-mail: taowang@jsnu.edu.cn

Abstract: In this presentation, firstly I will present the criteria for super-Poincaré inequalities by using the first Dirichlet eigenvalues under some proper assumptions. Of particular significance is the results for SDEs driven by symmetric stable processes which is closely related to the fractional Hardy-Rellich inequality. Drawing inspiration from Green functions, we will introduce new Lyapunov-type conditions utilizing Lyapunov function sequences $(W_n)_{n \geq 1}$. Furthermore, I will illustrate the applicability of these findings to a range of classic models, including birth-death processes, diffusion processes, and some Lévy-type processes.

Nonzero-sum discrete-time constrained stochastic games

Qingda WEI *Huaqiao University*, E-mail: weiqd@hqu.edu.cn

Abstract: In this talk we consider nonzero-sum discrete-time constrained stochastic games under the expected average payoff criteria. The state space can be a countable set or a Borel space, the action spaces of the players are Borel spaces and the cost functions can be possibly unbounded. Under suitable conditions, we construct an approximating sequence of the auxiliary constrained stochastic game models to prove the existence of a stationary constrained Nash equilibrium.

Wasserstein convergence rates for empirical measures of random subsequence of $\{n\alpha\}$

Bingyao WU *Fujian Normal University, China*, E-mail: bingyaowu@163.com

Abstract: Fix an irrational number α . Let X_1, X_2, \dots be independent, identically distributed, integer-valued random variables with characteristic function φ , and let $S_n = \sum_{i=1}^n X_i$ be the partial sum. Consider the random walk $\{S_n \alpha\}_{n \geq 1}$ on the torus, where $\{\cdot\}$ denotes the fractional part. We study the long time asymptotic behaviour of the empirical measure of this random walk to the uniform distribution under the general p -Wasserstein distance. Our results show that the Wasserstein convergence rate depends on the Diophantine properties of α and the Hölder continuity of the characteristic function φ at the origin, and there is an interesting critical phenomenon that will occur. The proof is based on the PDE approach developed by L. Ambrosio, F. Stra and D. Trevisan and the continued fraction representation of the irrational number α .

Functional inequalities on Gaussian path spaces

Bo WU, China *Fudan University*, E-mail: wubo@fudan.edu.cn

Abstract: In this talk, we will first introduce the Cameron-Martin theorem and integration by parts formula with respect to Gaussian Wiener measures, in particular, it includes the fractional Wiener measure; Moreover, we will establish three types of Logarithmic Sobolev inequalities, transportation cost inequality and differential Harnack inequality.

On McKean-Vlasov stochastic variational inequalities with irregular coefficients

Jing WU *Sun Yat-sen University, China*, E-mail: wjjosie@hotmail.com

Abstract: In this talk we are concerned with some problems of McKean-Vlasov stochastic variational inequalities with irregular coefficients, including the well-posedness, propagation of chaos, and approximations.

Quasi-stationary distribution inside a domain for strong-Feller Markov processes

Liming WU *ISAM, HIT and LMBP, Univ. Clermont-Auvergne*, E-mail: li-ming.wu@uca.fr

Abstract: In this talk I will discuss the quasi-stationary distribution (QSD) of a strong-Feller Markov process conditioned to be inside a domain, a subject of interests both in biology and statistical mechanics. We propose a quite general framework in which the existence, the uniqueness and the exponential convergence of the QSD can be proved. The kinetic Langevin's diffusions (even with singular potentials of interaction such as Coulomb, Lennard-Jones) enter in our framework.

This talk is based on my joint works [1], [2] with Arnaud Guillin, Boris Nectoux.

- [1] Arnaud Guillin; Boris Nectoux & Liming Wu (2024+). Quasi-stationary distribution for strongly Feller Markov processes by Lyapunov functions and applications to hypoelliptic Hamiltonian systems. *to appear in JEMS*. *Online*
- [2] Arnaud Guillin; Boris Nectoux & Liming Wu (2023). Quasi-stationary distribution for Hamiltonian dynamics with singular potentials. *Probab. Theory Related Fields* 185, no. 3-4, 921-959.

Stochastic generalized porous media equations arising in self-organized criticality

Weina WU *Nanjing University of Finance and Economics, China*, E-mail: wuweinaforever@163.com

Abstract: We establish the frameworks for the existence and uniqueness of strong solutions and SVI (stochastic variational inequality) solutions to stochastic generalized porous media equations arising in SOC (self-organized criticality) model. These frameworks include stochastic fast diffusion equations, stochastic fractional fast diffusion equations, the SOC model, and apply to cases with the state space being a manifold, a fractal or a graph. In addition, our results apply to operators $f(\mathbf{L})$, where f is a Bernstein function and \mathbf{L} is the drift operator. This talk is based on two papers, arXiv:2107.09878 (with Michael Röckner and Yingchao Xie) and arXiv:2402.01479 (with Benjamin Gess and Michael Röckner).

A blocking action against intelligence decreasing: characterising the minimum-entropy couplings

Xian-Yuan WU *Capital Normal University, China*, E-mail: wuxy@cnu.edu.cn

Abstract: Given probability distributions $\mathbf{p} = (p_1, p_2, \dots, p_m)$ and $\mathbf{q} = (q_1, q_2, \dots, q_n)$ with $m, n \geq 2$, denote by $\mathcal{C}(\mathbf{p}, \mathbf{q})$ the set of all couplings of \mathbf{p}, \mathbf{q} . For any $P \in \mathcal{C}(\mathbf{p}, \mathbf{q})$, let $H(P)$ be the Shannon entropy of P . In this paper, we solve the following optimization problem

$$\tilde{P} : H(\tilde{P}) = \inf_{P \in \mathcal{C}(\mathbf{p}, \mathbf{q})} H(P). \quad (2)$$

Actually, we solve the above problem (??) by transforming it to the following optimization problem

$$\tilde{P} : H(\tilde{P}) = \min_{P \in \mathcal{L}(\mathbf{p}, \mathbf{q})} H(P) \quad (3)$$

for some subset $\mathcal{L}(\mathbf{p}, \mathbf{q}) \subset \mathcal{C}(\mathbf{p}, \mathbf{q})$ with cardinality less than $\binom{mn}{m+n-1}$. In detail, by using a local optimization argument developed by the authors in a previous paper, we first characterise the special feature of a minimum-entropy coupling for problem (??), and then prove that all couplings with this feature lie in $\mathcal{L}(\mathbf{p}, \mathbf{q})$. The solving procedure of problem (??) is then generalized to the (Φ, \hbar) -entropy, a large class of entropy including Shannon entropy, Rényi entropy and Tsallis entropy. Note that at any case, in our specific algorithm, by solving a corresponding system of linear equations, we confirm whether or not $P \in \mathcal{L}(\mathbf{p}, \mathbf{q})$.

Successful couplings for switching diffusion systems with past-dependent switching

Fubao XI *Beijing Institute of Technology, China*, E-mail: xifb@bit.edu.cn

Abstract: In this work we consider a class of switching diffusion systems consisting of continuous and discrete components, in which the switching rates of discrete component depend on the value

of the continuous component involving past history. Motivated by the aim to study the strong ergodicity or uniform ergodicity in the sense of convergence in total variation norm, we construct a type of couplings for this class of switching diffusion systems, and give some sufficient conditions to guarantee this type of couplings to be successful. In addition, we also discuss some illustrative examples.

The interpretability of deep neural networks based on renormalization group

Zigeng XIA *Peking University, China*, E-mail: xiazigeng@pku.edu.cn

Abstract: Deep neural networks are currently the most concerned and widely used model in the field of artificial intelligence and machine learning. However, they have been considered to lack interpretability and often be classified as black box models. In this talk we consider interpreting the deep neural network model by constructing a rigorous correspondence between them and the renormalization group method from statistical mechanics. Renormalization group is a kind of method that aims to establish the connection between microscopic properties and macroscopic global properties of a physical system. The canonical renormalization group calculation is based on the coarse-grain operations or scale transformations. Intuitively, this is similar with the processing of the input data in the neural network, which we call it the non-canonical renormalization process. We start from this point of view and proposed a rigorous correspondence between the renormalization group of input data set and the training process of deep neural network model on same data. On two classes of data: one-dimensional Ising model and a specific class of exponential family distribution, we prove that in simulated annealing training process of the fully connected deep neural network, if the parameters of network reach the optimal value point, the limit of the characteristic parameter in the corresponding partition function of network output is the same as the fixed point of the characteristic parameter calculated by canonical renormalization group method. This shows that the training process of the neural network is actually equivalent to the canonical real space renormalization group, and both of them extract the same macroscopic global characteristics of the input dataset. As a conclusion, deep neural networks are effective on different tasks with large data sets since their equivalence to renormalization group, which is a successful method to extract macroscopic properties from microscopic properties.

Identifying the generator matrix of a stationary Markov chain using partially observable data

Xuyan XIANG *Hunan University of Arts and Science, China*, E-mail: xyxiang2001@126.com; xyxiang2019@huas.edu.cn

Abstract: Given that most states in real-world systems are inaccessible, it is critical to study the inverse problem of a stationary Markov chain regarding how a generator matrix can be identified using minimal observations. The hitting-time distribution of an irreversibly stationary Markov chain is first generalized from a reversible case. The hitting-time distribution is then decoded via the taboo rate, and the results show remarkably that under mild conditions, the generator matrix of a reversible Markov chain or a specific case of irreversibly stationary ones can be identified by utilizing observations from all leaves and two adjacent states in each cycle. Several algorithms are proposed for calculating the generator matrix accurately, and numerical examples are presented to confirm their validity and efficiency. An application to neurophysiology is provided to demonstrate the applicability of such statistics to real-world data. This means that partially observable data can be used to identify the generator matrix of a stationary Markov chain.

Conditioned random walks on linear groups: construction of the target harmonic measure

Hui XIAO *Chinese Academy of Sciences, China*, E-mail: xiaohui@amss.ac.cn

Abstract: The study of conditioned limit theorems for random walks with independent and identically distributed jumps on the real line has been initiated by Spitzer and Feller, and have attracted the interest of many authors in recent decades. The case of sums of dependent random variables is considerably less explored, mainly due to two challenges. The first one arises from the inapplicability of Wiener-Hopf factorization in this context. The second one is associated with the techniques of reversibility of the random walk, and the issue for dependent random variables is that, in general, the reversed random walk does not exhibit the same dependence structure as the direct random walk. In this talk we construct a novel entity – the target harmonic measure for random walks on the general linear group, constrained to a specific domain. This measure, together with the harmonic function, serves as a pivotal component in shaping the conditioned local limit theorem. This talk is based on joint work with Ion Grama and Jean-François Quint.

Limit theorems of Hawkes processes and stochastic Volterra equations

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Abstract: In this talk we introduce our recent results about the full functional limit theorems and scaling limit theorems for Hawkes Processes with limit processes being unique solution of stochastic Volterra equations with measure kernel. Additionally, we also give a short view on their applications in biology and finance.

The extinction behavior for a stochastic Lotka–Volterra type population system with competition

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Abstract: Applying some criteria, we study a two-dimensional process (X, Y) arising as the unique nonnegative solution to a pair of stochastic differential equations driven by independent Brownian motions and compensated spectrally positive Lévy random measures. Both processes X and Y can be identified as continuous-state nonlinear branching processes and their evolution are negatively affected each other. We identify rather sharp conditions on the extinction behavior of (X, Y) , respectively, one of the following behaviors: extinction with probability one, non-extinction with probability one or both extinction and non-extinction occurring with strictly positive probabilities. This talk is based on a joint work with Jie Xiong and Xiaowen Zhou.

Pólya urns with graph-based interactions

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Abstract: Given a connected graph, place a bin at each vertex. Two bins are called a pair if they share an edge. At discrete times, a ball is added to each pair of bins, and one of the bins gets the ball with probability proportional to its current number of balls raised by some fixed power $\alpha > 0$. We review some known results for this model (called graph-based Pólya urns) on finite graphs, and discuss some recent work concerning its long-time behavior on infinite graphs. We will also mention some variants of this model.

Long time propagation of chaos for mean-field SDEs

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Abstract: Firstly, we present the long time propagation of chaos in mean-square and in the almost surely for mean field SDEs, respectively. As an application, the mean-square and almost sure exponential stabilities of the Euler-Maruyama scheme associated with the corresponding interacting particle system are shown through an ingenious manipulation of empirical measure, then we show numerical solutions preserve the stabilities of the true solutions. Secondly, we investigate the long time quantitative propagation of chaos in total variation distance for mean field interacting particle system driven by general Lévy noise. Moreover, by using the method of coupling, the general result is applied to mean field interacting particle system driven by Brownian motion and $\alpha(\alpha > 1)$ -stable noise respectively, where the non-interacting drift is assumed to be dissipative in long distance and the initial distribution of interacting particle system converges to that of the limit equation in L^1 -Wasserstein distance.

Some recent progress in stochastic partial differential equations driven by pure jump Lévy noise

Jianliang ZHAI *University of Science and Technology of China, China*, E-mail: zhajl@ustc.edu.cn

Abstract: In this talk, I will present our recent progress in stochastic partial differential equations driven by pure jump Lévy noise.

The three dimensional stochastic Zakharov system

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Abstract: In this talk we will show some recent results for the three dimensional stochastic Zakharov system in the energy space, where the Schroedinger equation is driven by linear multiplicative noise and the wave equation is driven by additive noise. We will show the well-posedness of the system up to the maximal existence time and provide a blow-up alternative. We also prove that the solution exists at least as long as it remains below the ground state. Furthermore, we present a noise regularization result on finite time blowup before any given time. Two main ingredients of our proof are the refined rescaling approach and the normal form method. In contrast to the deterministic setting, our functional framework also incorporates local smoothing estimates for Schroedinger equations with derivative perturbations arising from the noise.

Nonstationary discounted decentralized stochastic games under prospect theory with applications to the smart grid

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Abstract: This study considers the discounted criterion of nonzero-sum decentralized stochastic games with prospect players. The state and action spaces are finite. The state transition probability is nonstationary. Each player independently controls their own Markov chain. The subjective behavior of players is described by the prospect theory (PT). Compared with the average criterion of stochastic games under PT studied first in 2018, we are concerned with the time value of utility; that is, utility should be discounted in the future. Because the PT distorts the probability, an optimality equation that plays a significant role in proving the existence of an equilibrium does not exist. On the other hand, the games change into Markov decision processes (MDPs) with a nonstationary payoff function when fixing others' stationary Markov strategies, then the occupation measure and linear programming of stationary MDPs are no longer suitable. Therefore, we explore a new technique by constructing the marginal distribution of state-action pairs at any time and establish the existence of a Nash equilibrium. When the initial state is given, we prove the existence of a Markov Nash equilibrium. Furthermore, this novel technique can be extended to the finite horizon criterion. We then propose an algorithm for determining the Markov ϵ -equilibrium. Finally, the model is applied to a noncooperative stochastic game among prosumers who can produce and consume energy in a smart grid, and we provide some simulation results.

On properties of the limits of Biggins' martingales of the branching Lévy processes

Rui ZHANG *Capital Normal University, China*, E-mail: zhangrui27@cnu.edu.cn

Abstract: Let $W_t(\theta)$ be the Biggins' martingale of a supercritical branching Lévy process with non-local branching mechanism under some exponential condition and denote by $W_\infty(\theta)$ its limit. In this paper, we mainly investigate properties of $W_\infty(\theta)$. We provide the sufficient and necessary conditions for $W_\infty(\theta)$ to have finite p th moment and give conditions for $\mathbb{E}(W_\infty(\theta)^p L(W_\infty(\theta))) < \infty$ where L is slowly varying at infinity. We also investigate tail probability problems of $W_\infty(\theta)$. As an application of these results, we establish a normal central limit theorem and stable central limit theorem for $W_t(\theta)$.

Metastability of random dynamical systems

Tusheng ZHANG *University of Science and Technology of China, China*, E-mail: tushengz@ustc.edu.cn

Abstract: In this talk, we first present a criterion on uniform large deviation principles (ULDP) of stochastic differential equations under Lyapunov conditions on the coefficients. In the second part, using the ULDP criterion we preclude the concentration of limiting measures of invariant measures of stochastic dynamical systems on repellers and acyclic saddle chains. Of particular interest, we determine the limiting measures of the invariant measures of the famous stochastic van der Pol equation and van der Pol Duffing equation whose noises are naturally degenerate.

\mathcal{W}_ρ -convergence rate of Euler-Maruyama schemes for SDEs driven by supercritical α -stable processes

Xiaolong ZHANG *Beijing Institute of Technology, China*, E-mail: zhangxl.math@bit.edu.cn

Abstract: In this paper we study the \mathcal{W}_ρ -convergence rate of Euler-Maruyama schemes for the unique invariant measure of stochastic differential equations driven by supercritical α -stable noise, that is $\alpha \in (\frac{1}{2}, 2)$, where \mathcal{W}_ρ is the Wasserstein distance with respect to the cost function ρ . Under certain Hölder continuities and dissipative conditions, we propose two ergodic EM schemes to approximate the invariant measures: one utilizes the Pareto noises, and the other employs α -stable noises. The key point is to solve the Stein equation under different cost functions and show the corresponding fractional order regularities by the heat kernel estimates.

Minimal position of branching random walks in random environment: critical case

Xiaoyue ZHANG *Capital University of Economics and Business, China*, E-mail: zhangxiaoyue@cueb.edu.cn

Abstract: We consider a branching random walk with a random environment in location, where the particles branch with a fixed law but move as a random walk in random environment. For the “critical case” that $\omega_{max} = \frac{1}{m}$ but $\eta(\omega_0 = \frac{1}{m}) > 0$ (Zhang et al., 2020), M_n , the minimal position of the branching random walk at time n , goes to infinity but $M_n/n \rightarrow 0$ as $n \rightarrow \infty$. We give an further estimate to M_n , that is, for almost all environment ω ,

$$\frac{M_n}{\log \log n} \rightarrow \frac{1}{\eta(\omega_0 = \frac{1}{m}) \log 2}, \quad P_\omega - a.e.,$$

which is quicker than the “critical case” (in non-random environment) that $\eta(\omega_0 = \frac{1}{m}) = 1$ (Bramson, 1978), but much slower than the “critical case” (in random environment) that $\omega_{max} = \frac{1}{m}$ but $\eta(\omega_0 = \frac{1}{m}) = 0$ (Nakashima, 2013). A key step in the proof is to give the asymptotic behavior of a regular branching process in random environment. This is a joint work with Professor Wenming Hong.

On absorbing Markov decision processes

Yi ZHANG *University of Birmingham, UK*, E-mail: y.zhang.29@bham.ac.uk

Abstract: Discounted, uniformly absorbing and absorbing Markov decision processes (MDPs) are in increasing generality. In this talk, we demonstrate some properties that are valid for discounted MDPs, but not for uniformly absorbing MDPs, characterize when absorbing MDPs are uniformly absorbing MDPs, under standard compactness-continuity conditions, namely (W) and (S), and present simple examples demonstrating the implications of these two conditions on the space of strategic measures and occupation measures (for absorbing MDPs).

Global existence and uniqueness of pathwise solution to the stochastic 3D inviscid Burgers equations

Guoli ZHOU *Chongqing University, China*, E-mail: zhouguoli736@126.com
collaborate with **Zhao DONG** *Chinese Academy of Sciences, China*

Abstract: Global well-posedness of stochastic 3D inviscid Burgers equations is addressed. In the present work, we find that if this inviscid hydrodynamics equation is perturbed by noise, the global well-posedness holds P-a.s. with initial data satisfying a certain Gevrey type bound. Moreover, the unique global solution to the stochastic inviscid 3D Burgers equation is bounded by the initial data.

Optimal consumption-leisure-investment and retirement choices with non-concave aspirational utility

Ming ZHOU *Renmin University of China, China*, E-mail: mingzhou@ruc.edu.cn

Abstract: This paper studies the optimal investment, consumption, leisure, and voluntary retirement problem in a continuous time life-cycle model. Except for standard goods, we incorporate aspirational goods which are non-divisible, prohibitively expensive, and generate a surge of utility. This leads to the individuals having a non-concave aspirational utility of consumption. The aspirational utility has a highly realistic feature that arises commonly in economic activities, such as external habits, status-seeking, and peer pressure. By employing martingale dual methods and variational inequality, we divide individuals into three categories: leisure-seekers, aspiration-seekers, and centrists based on priority pursuit aspiration or leisure, and derive semi-closed solutions for optimal strategies. Furthermore, with the calibration of the model, we explore the impact of aspiration level on optimal policies and offer some insights into the interlinkage between aspiration level and individual behavior.

Speeds of coming down from infinity for Λ -Fleming-Viot supports

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Abstract: Λ -Fleming-Viot process is a probability-measure valued process that is dual to a Λ -coalescent involving multiple collisions. Given a class of Λ -Fleming-Viot processes with the associated Λ -coalescents coming down from infinity and with Brownian spatial motion such that the compact support property holds, i.e. the support of such a process becomes finite as soon as $t > 0$ even though the initial measure has an unbounded support, we obtain asymptotic results characterizing how fast the supports become finite near time 0. Our results are expressed using the asymptotics of tail distribution of the initial measure and speed function of coming down from infinity for the associated Λ -coalescent.

Optimal harvesting problems with mean field interactions

Chao ZHU *University of Wisconsin-Milwaukee, USA*, E-mail: zhu@uwm.edu

Abstract: This work is focused on some ergodic impulse control problems in which the underlying controlled process between impulses is described by a diffusion process, and a long-term average cost criterion is used to evaluate decisions. We will first present a construction of the probability measure on the path space for an admissible intervention policy subject to a randomized impulse mechanism and identifies classes of impulse policies under which the resulting controlled process is Markov or the paths between interventions are independent and identically distributed following the initial cycle.

We will next study two impulse control problems. The first one deals with single-item continuous review inventory models with random supplies. Using average expected occupation and (nominal) ordering measures and weak convergence arguments, conditions will be given for the optimality of an (s_*, S_*) ordering policy in the general class of policies. The second problem studies an optimal harvesting problem with mean field interactions and derives conditions under which a mean field equilibrium strategy exists.

This is a joint work with Kurt Helmes (Humboldt University of Berlin) and Richard Stockbridge (University of Wisconsin-Milwaukee).

Abstracts of Posters:

Stochastic stability for linear autoregressive model with Gaussian innovations

Yu CHEN , E-mail: ychen0504@mail.bnu.edu.cn *Beijing Normal University.*

Abstract: Autoregressive model is a basic one among those time series models, whose stochastic stability is crucial, and often a prerequisite, for statistical inference and other applications. As a specific type of time series model, the linear autoregressive model has garnered significant attention due to its simplicity and ease of generalization. In this paper, we present a comprehensive characterization of stability for the linear autoregressive model with Gaussian innovations, including recurrence and transience, the convergence rate in the ergodicity case, and R-stability in the transience case. The linear autoregressive models are fully classified according to their stability, which is entirely determined by their coefficients.

Construction of remaining-lifetime age-structured branching processes by stochastic equations

Ziling CHENG *Beijing Normal University*, E-mail: zlcheng@mail.bnu.edu.cn
 Zenghu LI *Beijing Normal University*, E-mail: lizh@bnu.edu.cn

Abstract: We study age-structured branching models with reproduction law depending on the remaining lifetime of the parent. The lifespan of an individual is decided at its birth and its remaining lifetime decreases at the unit speed. The models without or with immigration are constructed as measure-valued processes by pathwise unique solutions of stochastic equations driven by time-space Poisson random measures.

The first eigenvalue of one-dimensional elliptic operators with killing

Kang Dai, Xiaobin Sun, Jian Wang, Yingchao Xie *Jiangsu Normal University, Fujian Normal University*, E-mail: kangdai@jsnu.edu.cn, xbsun@jsnu.edu.cn, jianwang@fjnu.edu.cn, ycxie@jsnu.edu.cn.

Abstract: In this paper, we investigate the first eigenvalue for one-dimensional elliptic operators with killing. Two-sided approximation procedures and basic estimates of the first eigenvalue are given in both the half line and the whole line. The proofs are based on the h -transform, Chen's dual variational formulas and the split technique. In particular, a few examples are presented to illustrate the power of our results.

Quasi-stationary distributions for continuous-time λ -recurrent jump processes

Qian DU *Beijing Normal University*, E-mail: duqian@mail.bnu.edu.cn

Abstract: For the continuous-time λ -recurrent jump process, the λ -recurrence assures the existence of quasi-stationary distribution when it has finite exit states (the states that have positive killing rates). And we give an explicit representation for this quasi-stationary distribution through Q -matrix, where the components of the quasi-stationary distribution outside the set H of exit states can be represented by those within H . Sufficient condition is also provided for quasi-stationary distribution when the exit states are infinite.

Exponential contractivity and propagation of chaos for Langevin dynamics of McKean-Vlasov type with Lévy noises

Yao Liu, Jian Wang, Meng-Ge Zhang *Fujian Normal University*, E-mail: liuyaomath@163.com, jianwang@fjnu.edu.cn, mgzhangmath@163.com

Abstract: By the probabilistic coupling approach which combines a new refined basic coupling with the synchronous coupling for Lévy processes, we obtain explicit exponential contraction rates in terms of the standard L^1 -Wasserstein distance for the following Langevin dynamic $(X_t, Y_t)_{t \geq 0}$ of McKean-Vlasov type on \mathbb{R}^{2d} :

$$\begin{cases} dX_t = Y_t dt, \\ dY_t = \left(b(X_t) + \int_{\mathbb{R}^d} \tilde{b}(X_t, z) \mu_t^X(dz) - \gamma Y_t \right) dt + dL_t, \quad \mu_t^X = \text{Law}(X_t), \end{cases}$$

where $\gamma > 0$, $b : \mathbb{R}^d \rightarrow \mathbb{R}^d$ and $\tilde{b} : \mathbb{R}^{2d} \rightarrow \mathbb{R}^d$ are two globally Lipschitz continuous functions, and $(L_t)_{t \geq 0}$ is an \mathbb{R}^d -valued pure jump Lévy process. The proof is also based on a novel distance function, which is designed according to the distance of the marginals associated with the constructed coupling process. Furthermore, by applying the coupling technique above with some modifications, we also provide the propagation of chaos uniformly in time for the corresponding mean-field interacting particle systems with Lévy noises in the standard L^1 -Wasserstein distance as well as with explicit bounds.

Exponential contraction rates for a class of degenerate SDEs with Lévy noises

Yao Liu, Jian Wang, Meng-Ge Zhang *Fujian Normal University*, E-mail: liuyaomath@163.com, jianwang@fjnu.edu.cn, mgzhangmath@163.com.

Abstract: Given a separable and real Hilbert space \mathbb{H} , we consider the following stochastic differential equation (SDE) on \mathbb{H} :

$$dX_t = -X_t dt + b(X_t) dt + dZ_t,$$

where $Z := (Z_t)_{t \geq 0}$ is a cylindrical pure jump Lévy process on \mathbb{H} which may be degenerate in the sense that the support of Z is contained in a finite dimensional space. When the nonlinear drift term

$b(x)$ is contractive with respect to some proper modified norm of \mathbb{H} for large distances, we obtain explicit exponential contraction rates of the SDE above in terms of Wasserstein distance under mild assumptions on the Lévy process Z . The approach is based on the refined basic coupling of Lévy noises, and it also works well when the so-called Lyapunov condition is satisfied.

Explicit representation of invariant measures for 2-death processes

Yi ZHAO *Beijing Normal University*, E-mail: zhaoyibnu@mail.bnu.edu.cn

Abstract: Construction of invariant measures is a challenging problem for Markov chains with multi-exit. In this paper, we obtain explicit representation of invariant measures for 2-death processes. And furthermore, the criterion for ergodicity is also derived based on this formula. In addition, several examples are demonstrated to verify the validity of our result.

Small positive values and limit theorems for supercritical branching processes with immigration in random environment

Yinxuan ZHAO *Beijing Normal University*, E-mail: yinxuanzhao@mail.bnu.edu.cn

Abstract: Let (Z_n) be a supercritical branching process with immigration in a random environment. The small positive values and some lower deviation inequalities for Z are investigated. Based on these results, the central limit theorem of $\log Z_n$ and the Edgeworth expansion are obtained. The study is taken under the assumption that each individual produces 0 offspring with a positive probability.

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