Abstracts of Keynote/Invited Speakers 6th Berlin Workshop for YOUNG RESEARCHERS (https://t1p.de/YoungResearchersBerlin2021)

Speaker	Title of the talk	Abstract
Acciaio, Beatrice (ETH Zürich)	Causal optimal transport & adapted Wasserstein distance: appl. in math. finance	In this talk I will review some of the applications of causal optimal transport and adapted Wasserstein distance in mathematical finance, from classical stochastic optimization problems to machine learning approaches.
Backhoff, Julio (Univ. of Vienna)	Adapted Wasserstein distances in mathematical finance	Adapted Wasserstein distances provide a way to compare stochastic processes. They are built from causal optimal transport problems in a similar way as Wasserstein distances are built from optimal transport. In this talk I will emphasize why adapted Wasserstein distances are not just one choice, but the right choice, when our aim is to study the geometry of stochastic processes. I will illustrate this by showing howsome of the most classical problems in mathematical finance (such as utility maximization, utility-based indifference pricing, super-hedging, and the valuation of american options) are all stable/continuous with respect to the law of the underlying stock price model when we use thadapted Wasserstein distance.
Cuchiero, Christa (Univ. of Vienna)	From signature methods to affine and polynomial processes processes and back	Signature methods represent a non-parametric way for extracting characteristic features from time series data which is essential in machine learning tasks. This explains why these techniques become more and more popular in Econometrics and Mathematical Finance. Indeed, signature based approaches allow for data-driven and thus more robust model selection mechanisms, while first principles like no arbitrage can still be easily guaranteed. In view of option pricing the key quantity that one needs to compute in these models is the expected signature of some underlying process. Surprisingly this can be achieved for generic classes of jump diffusions (with possibly path dependent characteristics) via techniques from affine and polynomial processes. More precisely, we show how the signature process of these jumps diffusions can be embedded in the framework of affine and polynomial processes, which have been -- due to their tractability -- the dominating process class prior to the new era of highly over-parametrized dynamic models. In other words, this means that in generic cases the infinite dimensional Feynman Kac PIDE of the signature process can be reduced to an infinite dimensional ODE either of Riccati or linear type. This then allows to get power series expansions for the expected signature and its Fourier-Laplace transform. (This talk is based on joint work with Francesca Primavera and Sara Svaluto-Ferro.)
Muhle-Karbe, Johannes (Imperial College London)	Demand Discovery	This paper models dynamic asset pricing in a financial market in which some investors are privately informed about their own personal current and future investment preferences. The result is that investors who are uninformed about other investors' preferences face additional randomness in prices — which we call asset demand risk — due to uncertainty about the level of future asset demands induced by the uncertain preferences of the privately informed investors. The amount of asset demand risk is endogenous in equilibrium because the trading process reveals — through a process we call demand discovery —information about investor preferences and, thus, about their future asset demands. Theoretical results suggest that asset demand risk and demand discovery are plausible and generic features of financial markets. Numerical examples show the quantitative impact of asset demand risk and demand discovery on asset pricing dynamics, price volatility, risk premia, and trading volume. (Joint work in progress with Michael Gallmeyer, Burton Hollifield, and Duane Seppi)
Tangpi, Ludovic (Princeton)	Backward propagation of chaos and large population games asymptotics	In this talk we will present a generalization of the theory of propagation of chaos to backward (weakly) interacting diffusions. The focus will be on cases allowing for explicit convergence rates and concentration inequalities in Wasserstein distance for the empirical measures. As the main application, we derive results on the convergence of large population stochastic differential games to mean field games, both in the Markovian and the non-Markovian cases. (The talk is based on joint works with M. Laurière and Dylan Possamaï.)
Zhou, Xunyu (Columbia U)	Policy Evaluation in Continuous Time and Space: A Martingale Approach	We propose a unified framework to study policy evaluation (PE) and the associated temporal difference (TD) methods for reinforcement learning in continuous time and space. We show that PE is equivalent to maintaining the martingale condition of a process. From this perspective, we find that the mean--square TD error approximates the quadratic variation of the martingale and thus is not a suitable objective for PE. We present two methods to use the martingale characterization for designing PE algorithms.

(**Zhou, Xunyu** continued**)**	(continued)	The first one minimizes a ``martingale loss function", whose solution is proved to be the best approximation of the true value function in the mean--square sense. This method interprets the classical gradient Monte-Carlo algorithm. The second method is based on a system of equations called the ``martingale orthogonality conditions" with ``test functions''. Solving these equations in different ways recovers various classical TD algorithms, such as TD(λ), LSTD, and GTD. Different choices of test functions determine in what sense the resulting solutions approximate the true value function. We demonstrate the theoretical results and corresponding algorithms with numerical experiments and applications. (Joint work with Yanwei Jia). (arxiv preprint: https:/arxiv.org/abs/2108.06655)