MARBLE 2022

3rd International Conference on Mathematical Research for Blockchain Economy

CONFERENCE PROGRAMME

12-14 July 2022

Vilamoura, Portugal

Sponsored by

Imperial College Business School | Brevan Howard Centre for Financial Analysis

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CHAIRS' WELCOME

It is our pleasure to welcome you to the 3rd International Conference on Mathematical Research for Blockchain Economy (MARBLE) being held as an in-person event in Vilamoura, Portugal from July 12 to July 14, 2022. This follows on from the first conference edition held in Santorini, Greece, in May 2019, and the second edition, held online, in August 2020. In contrast to many blockchain conferences and forums which are dedicated to applications and products, MARBLE focuses on the mathematics and economics behind blockchain, seeking to bridge the gap between practice and theory. It aims to provide a high-profile, cutting-edge platform for mathematicians, computer scientists and economists to present latest advances and innovations in key theories of blockchain.

The call for papers solicited research papers across a number of themes including game theory, governance, incentives, stablecoins, decentralised finance and security. Of the submissions, 14 were accepted for publication and presentation, and of the accepted papers, a handful of the top-ranked submissions have been chosen for consideration for the Best Paper Award, which will be presented at the closing session.

The technical programme also features keynotes by the following distinguished speakers: Michael Zargham, Ioana Surpateanu, Cathy Mulligan, Rob Hygate, Arda Akartuna, Raphael Mazet, and Stefania Barbaglio as well as a tutorial on the subject of decentralised finance by Lewis Gudgeon, Daniel Hernandez Perez, Dragos Ilie and Sam Werner..

We thank all authors who submitted their innovative work to MARBLE 2022 this year. In addition, we thank all members of the Technical Programme Committee and other reviewers, everyone who submitted a paper for consideration, the TPC Chairs Elise Alfieri and Stefanos Leonardos, the Organisation Chair Jaswinder Gill, the Publication Chair Ilias Kotsireas, the Web Chair Kai Sun, and members of the Centre for Cryptocurrency Research and Engineering who have contributed in many different ways to the organisation effort, particularly Katerina Koutsouri and Lewis Gudgeon.

We are grateful to our sponsor, the Brevan Howard Centre for Financial Analysis for the generous support. Finally, we thank all participants of MARBLE 2022, as we rely on you to make this event interactive, engaging, and thought-provoking for everyone involved. We hope you will not only enjoy the technical programme but will also enjoy the social events including the conference reception, banquet and boat tour.

William Knottenbelt
General Chair
Imperial College London

Yike Guo
General Chair
Imperial College London

Panos Pardalos
General Chair
University of Florida

LOCALITY

Conference Venue Information

Tivoli Marina Vilamoura Algarve Resort
Address: Tivoli Marina Vilamoura, Loja 7, 8125-901 Quarteira, Portugal
Tel: +35 128 930 3303

Accomodation Recommendations

Vila Galé Amphalius
Address: Alameda Praia da Marina, 8125-408 Quarteira, Portugal
Tel: +35 128 930 3900

Dom Pedro Marina Vilamoura
Address: Avenida Tivoli Lote H4, 8125-410 Algarve, Portugal
Tel: +35 128 930 0780

Crown Plaza Vilamoura
Address: Rua do Oceano Atlantico, Apartado 1121, EC, 8126-913, Portugal
Tel: +35 128 938 1600

Vila Galé Marina
Address: Av. da Marina, 8125-406 Quarteira, Portugal
Tel: +35 128 930 0000

Restaurants

O Cesteiro	+35 191 050 3906
Akvavit	+35 128 938 0712
Salmora	+35 192 680 8099
El Cristo	+35 128 924 6161
Il Lamparo	+35 128 938 9125
Don Alfonso	+35 128 931 2688

Taxis

Q&P Taxi-Transfers	+35 196 210 0993
Portugal Airport Transfer	+35 191 847 9655

Emergency Numbers

Police, Fire Department, Ambulance 112

Vilamoura Tennis & Padel Academy
Intermarché Vilamoura
Family Golf Park
R. Melvin Jones
Pinhal d
Cerro da Vila Estação Arqueológica
Temporarily closed
Av. Cerro da Vila
R. do Sol
R. Dom Dinis
McDonald's - Vilamoura
Vila Galé Marina
Dom Pedro Marina Vilamoura
Conference Venue
Tivoli Marina Vilamoura Algarve Resort
Vila Galé Amphalius
Crown Plaza Vilamoura
Praia de Vilamoura
Água Qlub - Vilamoura

SESSIONS

Time	Tuesday, 12/7/22	Wednesday, 13/7/22	Thursday, 14/7/22
8:00 AM	Registration		
8:50 AM	Opening		
9:00 AM	Keynote Talk	Keynote Talk	Keynote Talk
9:30 AM			
10:00 AM	Keynote Talk	Keynote Talk	Keynote Talk
10:30 AM			
11:00 AM	Coffee break	Coffee Break	Coffee Break
11:30 AM	DeFi Tutorial	Technical Session 3	Technical Session 4
12:00 PM			
12:30 PM			
1:00 PM	Lunch		Conference Closing
1:30 PM		Lunch	Lunch
2:00 PM	Technical Session 1		
2:30 PM			
3:00 PM		Boat Trip	
3:30 PM	Coffee Break		
4:00 PM	Technical Session 2		
4:30 PM			
5:00 PM			
5:30 PM			
6:00 PM			
6:30 PM	Drinks Reception		
7:00 PM			
7:30 PM			
8:00 PM	Conference Banquet		

Technical Session 1: DeFi I

Tuesday 12 July, 14h00-15h30

- Daniel Perez and Lewis Gudgeon. **Disimilar Redundancy in DeFi**
- Lucy Huo, Ariah Klages-Mundt, Andreea Minca, Frederik Munter and Mads Wind. **Decentralised Governance of Stablecoins with Closed Form Evaluation**
- Aaron Green, Christopher Cammilleri, John Erickson, Oshani Seneviratne and Kristin Bennett. **DeFi Survival Analysis: Insights into Risks and User Behaviours**

Technical Session 2: Game theory and mining

Tuesday 12 July, 16h00-17h30

- Yun Kuen Cheung, Stefanos Leonardos, Shyam Sridhar and Georgios Piliouras. **Market Equilibria and Risk Diversification in Blockchain Mining Economies**
- Rami Khalil and Naranker Dulay. **Towards Equity in Proof-of-Work Mining Rewards**
- Yun Kuen Cheung, Stefanos Leonardos, Shyam Sridhar and Georgios Piliouras. **Griefing Factors and Evolutionary (In-)Stabilities in Blockchain Mining Games**
- Hans Gersbach, Akaki Mamageishvili and Manvir Schneider. **On Impact of Vote Delegation**

Technical Session 3: DeFi II

Wednesday 13 July, 11h30-13h30 (a), 11h30-12h30 (b)

- Abiola Salau, Ram Dantu, Kirill Morozov, Kritagya Upadhyay and Syed Badruddoja. **Multi-tier Reputation for Data Cooperatives**
- Toshiko Matsui and Daniel Perez. **Data-driven analysis of central bank digital currency (CBDC) projects drivers**
- Yongge Wang. **Prediction Markets, Automated Market Makers and Decentralised Finance (DeFi)**
- Jen Houng Lie, Wing Hong Tony Wong and Alex Yin-Ting Lee. **Wombat - An efficient stableswap algorithm**

Technical Session 4: Infrastructure and security

Thursday 14 July, 11h30-13h00

- David Chaum, Mario Larangeira and Mario Yaksetig. **Tweakable Sleeve: A Novel Sleeve Construction based on Tweakable Hash Functions**
- Maxim Jourenko, Mario Larangeira and Keisuke Tanaka. **Interhead Hydra: Two Heads are Better than One**
- Behkish Nassirzadeh, Huaiying Sun, Sebastian Banescu and Vijay Ganesh. **Gas Gauge: A Security Analysis Tool for Smart Contract Out-of-Gas Vulnerabilities**

KEYNOTE SPEAKERS

Michael Zargham

Michael Zargham is the founder and Chief Engineer at BlockScience, and a Core Member of the Metagovernance Project. He holds a Ph.D. in Electrical and Systems Engineering from the University of Pennsylvania where he studied Optimal Resource Allocation Policies in Networks. His ongoing work focuses on engineering best practices in estimation, decision, and control, as applied to mechanism design, operations research, and institutional analysis and development.

Formal Methods for Design and Analysis of Automated Agreements

Tuesday, July 12th

Formal Methods for design and analysis of complex systems rely heavily on models. When these models serve as the basis of decision making systems, their defining assumptions become entrenched. All too often, these assumptions are behavoiral in nature – "if A does X, then B does Y" – such assumptions provide the basis for existence, uniqueness and convergence proofs for equilibria. Unfortunately, these assumptions are notoriously fragile. Human decision makers are not determistic consumers of information, they are information sources. What happens if we forgo any assumptions about which actions will be taken, and instead focus on what actions are available? In this framing, one must move away from analysis of any particular trajectory within the statespace and focus on which points can be reached via sequences of admissible actions. It is possible to formally characterize, conditional upon the restrictions that action admissibility places on a dynamical system, the set of reachable points in the statespace defined by those restrictions. This 'configuration space' approach offer powerful tools for both design and analysis of automated agreements.

Ioana Surpateanu

Ioana Surpateanu is a Web3 and DeFi investor, adviser and entrepreneur. She strategically supports a variety of projects such as Swash, Poolz Finance, Cryptowalkers and focuses on various verticals within the Metaverse and the DeFi 2.0 ecosystem. She sits on the Executive Board of the Multichain Asset Managers Association, a global community of organisations working to transform asset management through blockchain technology.

Regulating the Metaverse

Tuesday, July 12th

There's substantial hype around Web3, the Metaverse, NFTs, blockchain gaming, digital fashion, etc; however, there are relevant infrastructure and intra-Metaverse dynamic issues with potential regulatory implications, which don't take centre stage. I am leading the design on an industry position re: NFT standards, clarity re NFT commercial rights, metadata storage and implications on NFT ownership models, sub-optimal infrastructure, inter-entity value portability in the Metaverse & subsequent financial regulation applicability, SSI, decentralised reputation models and distributed coordination mechanics as cornerstones for a DAO powered Metaverse.

KEYNOTE SPEAKERS

Cathy Mulligan

Cathy Mulligan is the European Research Area Chair in Blockchain at Instituto Superior Técnico, where she leads a Lab dedicated to research in Blockchain for Social Good and Sustainability. Cathy is an interdisciplinary researcher focusing on Digital technologies and Digital transformation from the perspectives of Engineering and Economics. Her technical research focuses on the new architectural / protocol paradigms for telecommunications networks due to emerging digital technologies and changing economic structures. She has written 7 books on telecommunications engineering. Cathy received her PhD and MPhil at the University of Cambridge. Cathy has advised multiple governments, companies, and NGOs on Digital Transformation & Cryptocurrency / Blockchain. She is a Visiting Lecturer at Imperial College London, where she teaches "Digital Transformation: Leading Real-World Change" and co-founded the Imperial College Centre for Cryptocurrency Research and Engineering.

Rob Hygate

Rob is currently the CTO and co-founder of eWATER Services, a leading edge technology solution and water utility in developing countries. Rob uses his technological background experience of web2 and web3, microelectronics, engineering, programming, communications and blockchain technology, mixed with his executive experience of leadership and vision with his global involvement, working in diverse cultures in developing countries, to provide a unique skill to help solve the world's water crisis. He has founded technology powered service organisations, growing them to success, including a global video conference service, a distributed print management service and a water utility management service.

DAOs for Dignity: How to Overthrow the World Bank and Deliver Real-World Change with DeFi

Wednesday, July 13th

The emergence of decentralized finance (DeFi) in the last few years brings new hope. In November of 2021, the total value locked liquidity in DeFi reached a staggering US$250 billion – despite the current fluctuations interest in these new types of financial solutions is continuing to grow. At the same time, the world faces increasing problems with regards to overcoming poverty, providing appropriate access to infrastructure, and dealing with climate change. So far DeFi has little to show in terms of doing any real-world good; lots of projects claim environmental impact or that they are helping to achieve the SDGs – but the evidence on the ground of genuine impact is relatively light. The heavily profit-driven angles currently seen in DeFi therefore do not help solve challenges such as financial inclusion, affordable public services, and environmental sustainability. Governments worldwide face a shortfall in available funds for infrastructure development. With the correct approach, infrastructure projects can provide the crypto community with the opportunity to invest in financial products with bond-like risk levels with a respectable expected return. Through their decentralized governance, ESG-conscious DAOs have the power to prioritize projects that are environmentally and socially sustainable, enabling new forms of infrastructure rollout that preserve the dignity of those being served, prevent climate change, and create new jobs related to civil infrastructure. Within this talk, we present the theory and the real-world application.

KEYNOTE SPEAKERS

Arda Akartuna

Eray Arda Akartuna is a Cryptocurrency Threat Analyst at blockchain analytics firm Elliptic. He is also a PhD researcher at University College London (UCL), funded by the Dawes Centre for Future Crime, analysing the money laundering and terrorist financing risks of emerging technologies. His research mainly focuses on cryptoasset-based terrorist/extremist financing, dark web markets, stolen credit card vendors, NFT-based crimes and DeFi exploits. He has advised numerous international organisations and public/private sector institutions on crypto crime risks. He holds a masters degree, also from UCL, in Countering Organised Crime and Terrorism.

The Darker Side of DeFi: Quantifying DeFi and NFT-based financial crime

Wednesday, July 13th

Over the course of 2021, one DeFi exploit occurred every three days, each stealing on average around $16 million. Throughout the same year, NFTs soared in popularity, causing rising concern about their potential money laundering risks. Elliptic released a landmark report into DeFi-based crimes (DeCrime), analysing many of these trends, in November 2021. It will soon release another, presenting perhaps the most comprehensive quantitative study into the phenomenon of NFT-based money laundering, terrorist financing, sanctions evasion and scams. The findings and trends from both these reports will be presented here, placing the darker side of these phenomena in context to better understand reputational, security and regulatory compliance risks.

Raphaël Mazet

Raphaël is the co-founder and CEO of SimpleFi, a data analytics platform for DeFi (Decentralized Finance). He has founded several blockchain-based social impact and DeFi protocols since 2016, often working in collaboration with Imperial College's Centre for Cryptocurrency Research and Engineering on R&D projects funded by Innovate UK. Raphaël is French and British, a post-grad from the LSE and currently lives in sunny Lisbon.

DeFi: Dos and Don'ts in bulls and bears

Thursday, July 14th

How do you play your cards right in DeFi? Using SimpleFi's in-depth data analytics, Raphaël exposes the strategies that generate the best returns in both bull and bear markets, and provides insights into how you can avoid getting "rekt" on your LP and yield farming investments.

KEYNOTE SPEAKERS

Stefania Barbaglio

London-based entrepreneur, business strategist and PR expert focused on new technologies and high-impact projects with over 10 years' experience in financial markets. As the founder and CEO of the boutique Investor & Public Relations agency Cassiopeia Services, she has worked a range of private and listed companies across numerous sectors and facilitated multiple deals globally. In the technology space, she has advised a variety of international blockchain application focused companies on their ground-breaking projects, leading on business strategies and marketing activities. She is part of the founding team at cross-chain bridging infrastructure Umbria Network and leading business development for brands at IOHK. She was one of the first people to recognise the valuable contribution that blockchain can bring to the fashion industry. Stefania has guided various firms in business development, fundraising and organisational dynamics, as well as leading large-scale tech and investment events. An influencer with a large investor following, Stefania is considered one of the top British female opinion leaders in the crypto sphere and featured as top female influencer by Yahoo Finance . She is also the creator and host of the financial + crypto focused YouTube channel and podcast FinancialFox. Stefania is a board member of London-listed Ondo Insurtech, the first UK listed Insurtech company.

DeFi, NFTs and Interoperability

Thursday, July 14th

The future of crypto, especially in regard to decentralised finance and NFT adoption for development of the Web3 ownership economy, depends on interoperability standards that go beyond EVM-compatible chains. The current status of the crypto industry is still very technical but also fragmented with multiple chains and projects working in silos; liquidity is fragmented as well as it is the community. As more people, businesses and institutions are entering crypto, user experience become the priority in promoting adoption: faster and cheaper ways to move assets cross chains. Umbria Network is a project focused on improving user experience via a fast and cheap cross-chain bridges solution powered by liquidity provision. As we are embracing a multichain world, we need interoperability standards as well as a clear regulatory framework.

TUTORIAL

Lewis Gudgeon

Lewis is a Computer Science PhD candidate at Imperial College London, publishing mainly on DeFi risks. Prior to this he worked as an economics consultant. He holds an MPhil in Economics Research from the University of Cambridge and a BA in Philosophy, Politics and Economics from Warwick University.

Daniel Perez

Software engineer with 10+ years of experience and open-source advocate with over 3,000 GitHub stars. Currently Daniel is finishing up his PhD at Imperial College London, where his research is on the security of blockchain systems and applications.

Dragos Ilie

Dragos is a PhD candidate at Imperial College London, researching Blockchain security and consensus protocols. He published work on Bitcoin's vulnerability against quantum computing and protocols to transition current blockchains to a quantum resistant scheme. As a software developer, he worked extensively on DeFi projects, designing Smart Contract architectures and building systems that interact with multiple DeFi building blocks.

Sam Werner

I am a PhD student in the Centre for Cryptocurrency Research and Engineering at Imperial College London, supervised by Professor William Knottenbelt. In my research I am trying to answer questions around incentive structures found in blockchain systems, ranging from mining pools to Decentralised Finance (DeFi) protocols. My latest research work includes a Systematisation of Knowledge on DeFi, examining different types of economic and technical security risks found in DeFi protocols.

DeFi Building Blocks

Tuesday, July 12th

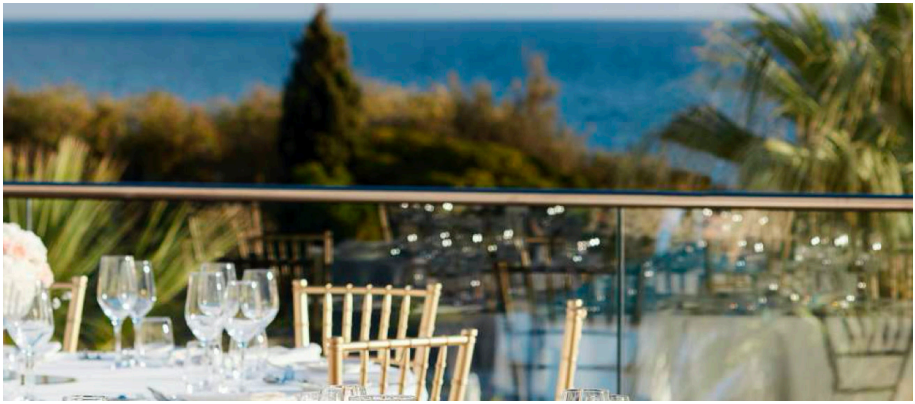
Want to learn how to DeFi? In this tutorial on Decentralized Finance (DeFi) we will first survey the state of the art in DeFi, synthesizing and evaluating some of its key technical innovations, before presenting a taxonomy of the major protocols. This will be based on the Systematization of Knowledge (SoK) coauthored by several of the presenters.

We will then turn to a live coding portion of the tutorial where we will showcase a number of pieces of DeFi program logic, highlighting important programming patterns and capabilities of DeFi protocols at present. The aim is to provide newcomers to DeFi with an expansive and insightful tour of the field.

SOCIAL EVENTS

Drinks Reception - Tuesday, July 12th

Ocean Lounge Terrace, Tivoli Marina Vilamoura



Conference Banquet - Tuesday, July 12th

Purobeach, Tivoli Marina Vilamoura

An opportunity to connect with colleagues whilst enjoying views of the beach and sea in a relaxing environment, the Purobeach Restaurant offers dishes that have been created using local ingredients and suppliers.

Marina de Vilamoura, 8125-901 Quarteira, Portugal
+35 1289 303 740

CONFERENCE EXCURSION

Boat Tour - Wednesday, July 13th

Ocean Quest Algarve

An opportunity to see the Algarve by Boat, refreshments will be served on board throughout the trip. Weather permitting a stop will be made at the Bengail Caves and an opportunity to swim in the crystal clear waters. Please ensure you wear suitable clothing and bring sun protection for the trip.

Ocean Quest, Edificio VilaMarina,
Lotes 1B.2.1 E 1.B.2.2, Bloco B
Loja 29, 8125-409 Vilamoura
+35 1289 102 181

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