

Ulysse Pavloff

Protocol Researcher — Distributed Systems, Game Theory

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Research Interests

My work aims to formalize and analyze the incentive compatibility of blockchain consensus protocols, bridging distributed computing and game theory. I focus on blockchain robustness, adversarial modeling, and mechanism design for consensus protocols, with a particular emphasis on Ethereum's Proof-of-Stake and validator incentives.

Education

- CEA, Paris-Saclay University**, *PhD in Computer Science* Nov 2021 – Nov 2024
- **Research area:** Distributed Computing and Game Theory with a focus on *blockchain robustness* and *incentive mechanisms*.
 - **Thesis:** *A Game-Theoretic Approach to the Study of Blockchain's Robustness*. Focused on Ethereum's Proof-of-Stake (PoS) protocol to derive general insights into robust protocol design.
 - **Key contributions:** Formalized the Ethereum PoS protocol (clean pseudo-code from specs/implementation); identified how *inactivity leaks* and *penalty/incentive mechanisms* can both strengthen and compromise robustness; showed that rational validators converge to compliant behavior under equilibrium conditions, clarifying the incentives–security interplay.
 - **Teaching:** Courses on Ethereum PoS and robust protocol design at *École Polytechnique*, *HEC Paris*, and *ENSIIE*.
 - **Advisors:** Sara Tucci-Piergiovanni, Yackolley Amoussou-Guenou.
- Sorbonne University**, *Master's in Computer Science (Game Theory & AI)* Sept 2019 – Sept 2021
- Sorbonne University**, *BSc in Mathematics & BSc in Computer Science* Sept 2016 – Sept 2019

Experience

- Game Theory & Strategic Optimisation Lead — Kolm Shield (Remote)** 2025 – present
- Designed incentive-aware mechanisms to detect/prevent fraudulent cross-chain bridge transactions; integrated decision layers with ML and PQC teams.
 - Built adversarial models and mechanism-design approaches for robust fraud detection under strategic attackers.
- Blockchain and ZK Content Author — Node Guardians (Remote)** 2022 – 2023
- Authored technical content on zk-SNARKs and blockchain with paired quizzes; *804 reads / 653 quizzes completed* (ref: Hector Roussille).
- Research Internship — Paris Dauphine University (France)** Jan 2021 – Jun 2021
- Monte Carlo Tree Search & Game Theory for voting systems. Paper: *Sequential Elimination Voting Games*; worst-case vs average-case manipulation gap.

Publications

- Pavloff, U., Amoussou-Guenou, Y., Tucci-Piergiovanni, S. *Ethereum Proof-of-Stake and the Probabilistic Bouncing Attack*. ACM DLT Journal.
- Pavloff, U., Amoussou-Guenou, Y., Tucci-Piergiovanni, S. *Incentive Compatibility of Ethereum's PoS Consensus Protocol*. OPODIS 2024.
- Pavloff, U., Amoussou-Guenou, Y., Tucci-Piergiovanni, S. *Byzantine Attacks Exploiting Penalties in Ethereum PoS*. DSN 2024.
- Pavloff, U., Amoussou-Guenou, Y., Tucci-Piergiovanni, S. *Ethereum Proof-of-Stake under Scrutiny*. SAC 2023.
- Attiya, H., Del Pozzo, A., Milani, A., Pavloff, U., Rapetti, A. *The Synchronization Power of Auditable Registers*. OPODIS 2023.

- **Pavloff, U.**, Amoussou-Guenou, Y., Tucci-Piergiovanni, S. *Exploitation des amendes dans Ethereum PoS*. AlgoTel 2024.
- **Pavloff, U.**, Cazenave, T., Lang, J. *Sequential Elimination Voting Games*. arXiv, 2022.

Teaching

- **École Polytechnique** (with Julien Prat), Guest Lecturer — Ethereum consensus; scalability and security.
- **HEC Paris** (with Bruno Biais), Teaching Assistant — Ethereum consensus with DeFi applications.
- **ENSIIE**, Teaching Assistant — Solidity programming & smart contracts (hands-on).
- **Paris-Saclay University**, Teaching Assistant — Intro to coding, Git, Agile, dev best practices.

Conference and Seminar Talks

- Jan 2025 — *Byzantine Attacks Exploiting Penalties in Ethereum PoS*, Scientific DILS day, Palaiseau, France.
- Nov 2024 — *A Game-Theoretic Analysis of Blockchain Robustness*, PhD Defense, Palaiseau, France.
- Aug 2024 — *Byzantine Attacks Exploiting Penalties in Ethereum PoS*, DSN, Brisbane, Australia.
- Jun 2024 — Participant (invited), Summer School on Real-World Crypto and Privacy 2024, Vodice, Croatia.
- May 2024 — *Exploitation des amendes dans Ethereum PoS*, Algotel, St-Briac, France.
- Feb 2024 — *Ethereum PoS and the Probabilistic Bouncing Attack*, Apéro Défi, Paris, France.
- Mar 2023 — *Ethereum PoS under Scrutiny*, SAC, Tallinn, Estonia.
- Jun 2023 — *Intro to zk-SNARKs*, Invited, Blockchain Bytes, Palaiseau, France.
- Feb 2023 — *Ethereum PoS*, Invited, Blockchain@X, Paris, France.
- Mar 2022 — *Ethereum Consensus Protocol*, Invited, Blockchain Bytes, Palaiseau, France.

Technical Skills

- **Blockchain & Cryptography:** Ethereum Proof-of-Stake, EVM, consensus mechanisms, MEV, incentive design, adversarial modeling, Solidity, zk-SNARKs
- **Backend & Frontend:** Node.js, Express, FastAPI, REST APIs, React, TypeScript
- **Languages & Tools:** Python, JavaScript, Java, C++, SQL, Git, Docker, GitHub Actions, L^AT_EX

Languages

French: Native **English:** Fluent