



Protocol cryptoeconomics with the RIG

Barnabé Monnot (🐦 [@barnabemonnot](https://twitter.com/barnabemonnot))

Ethereum Foundation

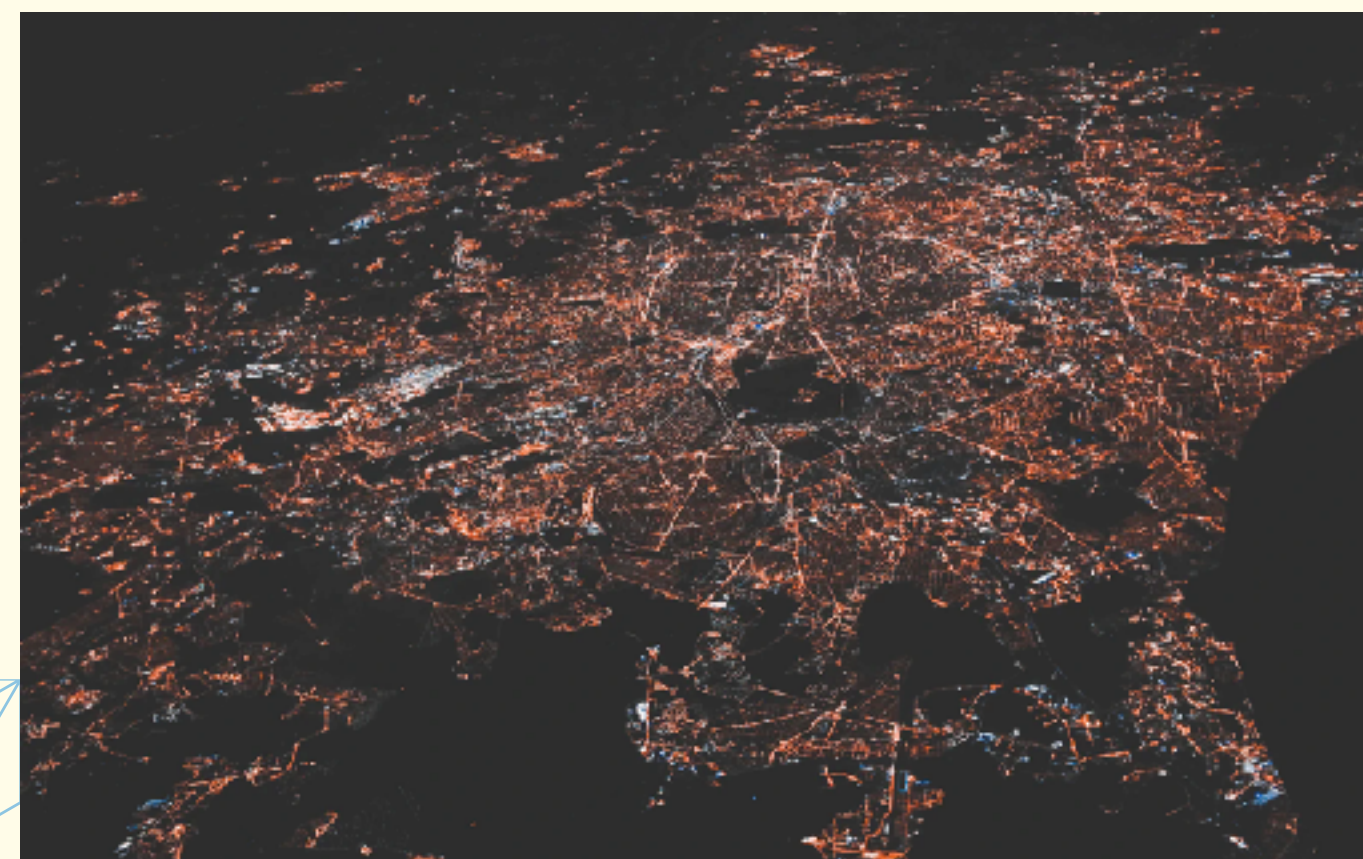
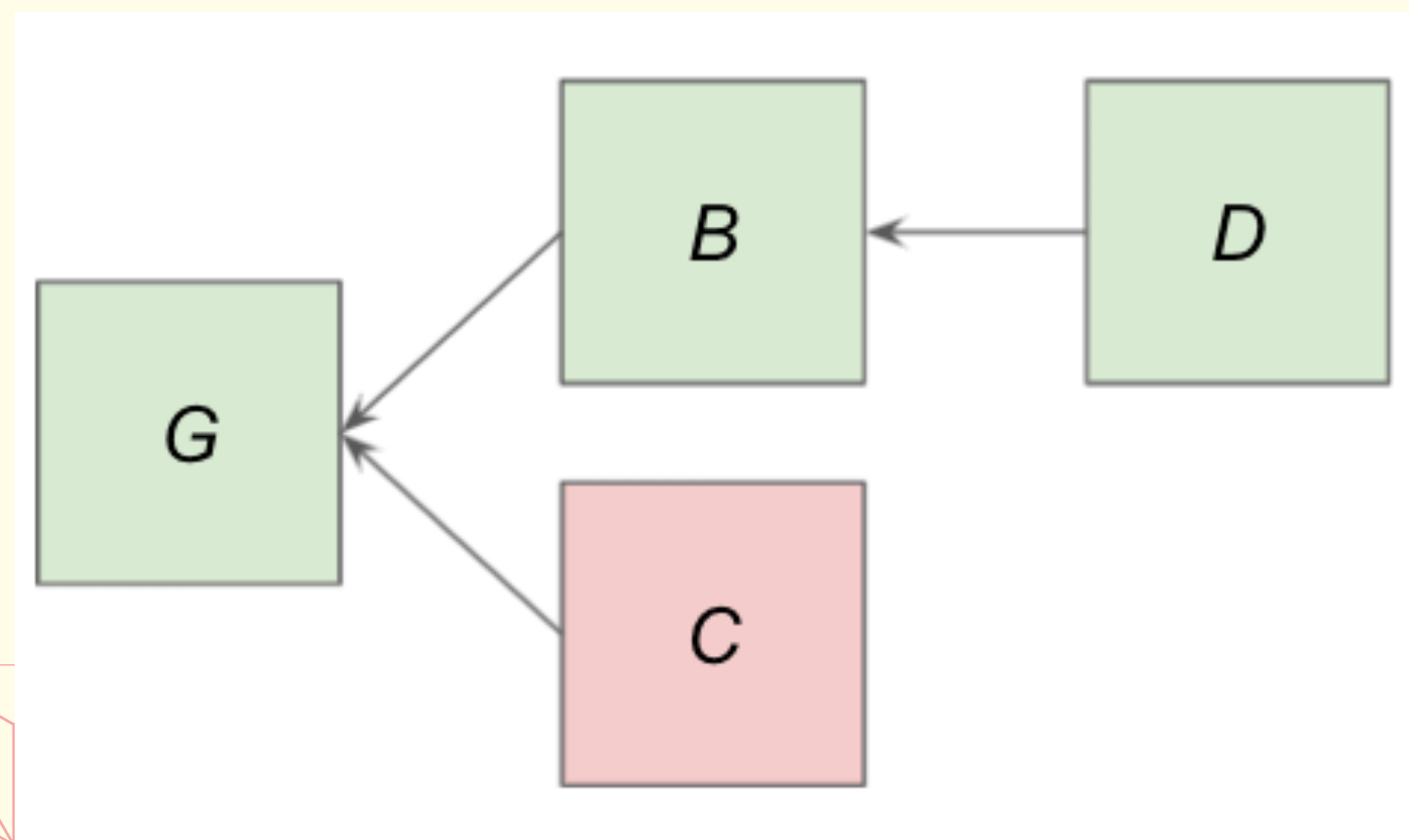
Robust Incentives Group (RIG)

These slides: <https://ethereum.github.io/rig>





Robust Incentives Group (RIG)

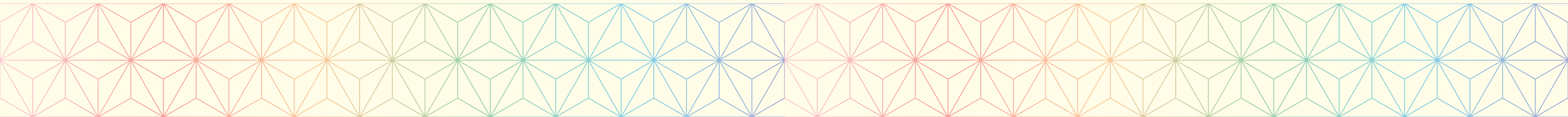
Ethereum research team focused on everything with *strategic* flavour

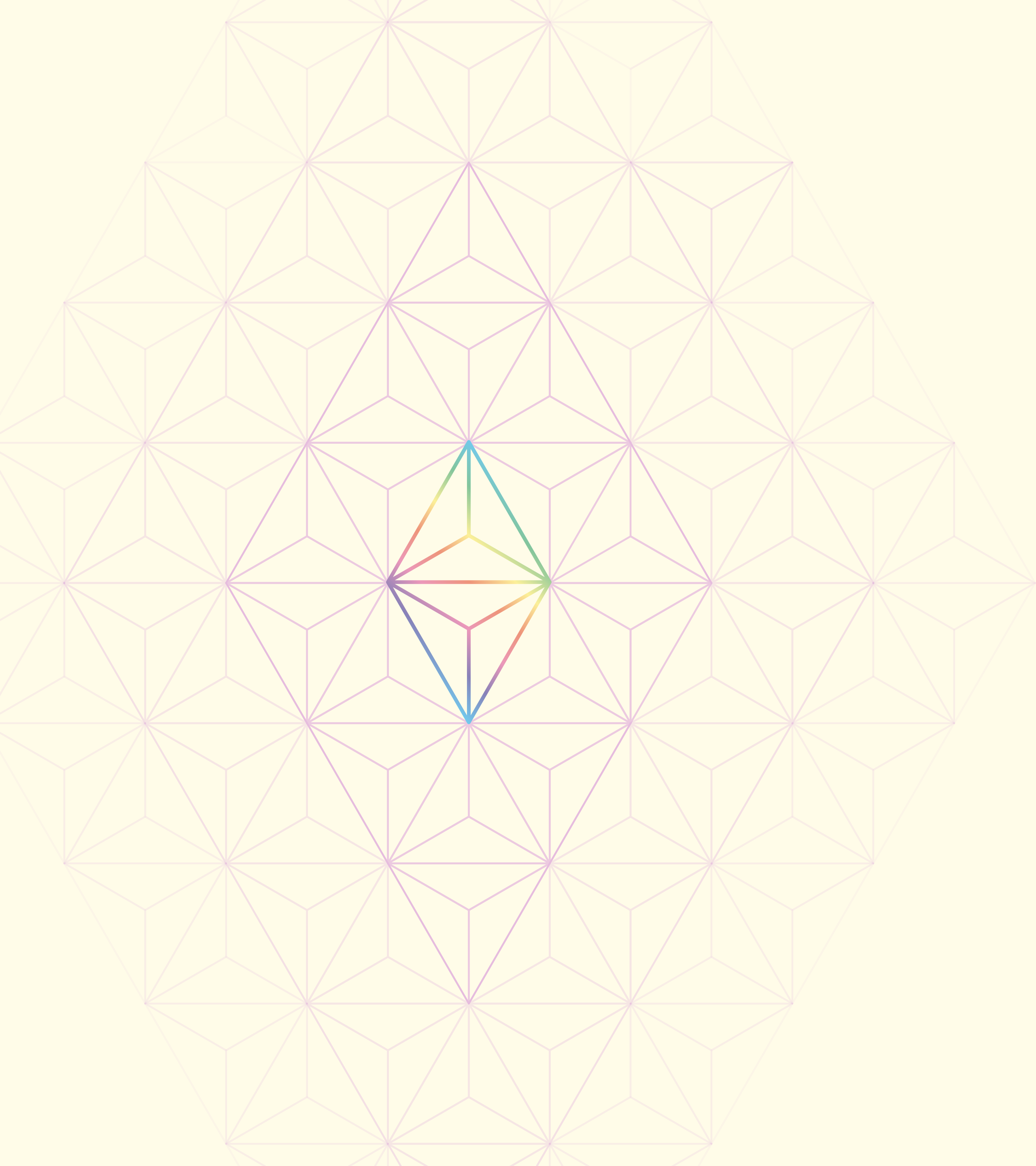
- 🎨 Strategic in the sense:
 - 🎨 Stakeholders make decisions to optimise their payoffs
 - 🎨 Their payoffs are affected by decisions of other stakeholders
- 🎨 Extremely general model to study *protocol security/cryptoeconomics*



Today

-  Discuss *methodology and results*
-  Simulations of the transaction fee market and [EIP-1559](#)
-  Simulations of the beacon chain / consensus layer of [Proof-of-Stake](#)
-  Present *a new model for community economic modelling*





Modelling EIP-1559

What is EIP-1559?

EIP-1559: A transaction fee market reform to add dynamic congestion pricing

- Users must pay a minimum fee (“base fee”)
- Minimum fee increases when more users want to transact, decreases otherwise
- Blocks are “double-sized”, max capacity 200%, target 100% fullness
- Users declare a priority fee and their maximum fee, pay **current base fee + priority fee**
- See Tim Beiko’s talk today!
2:50 pm, Poissy Room (this room)

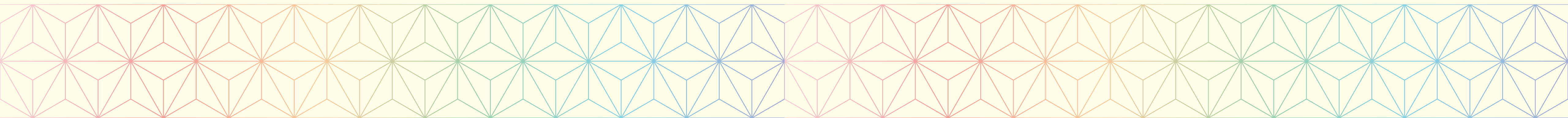
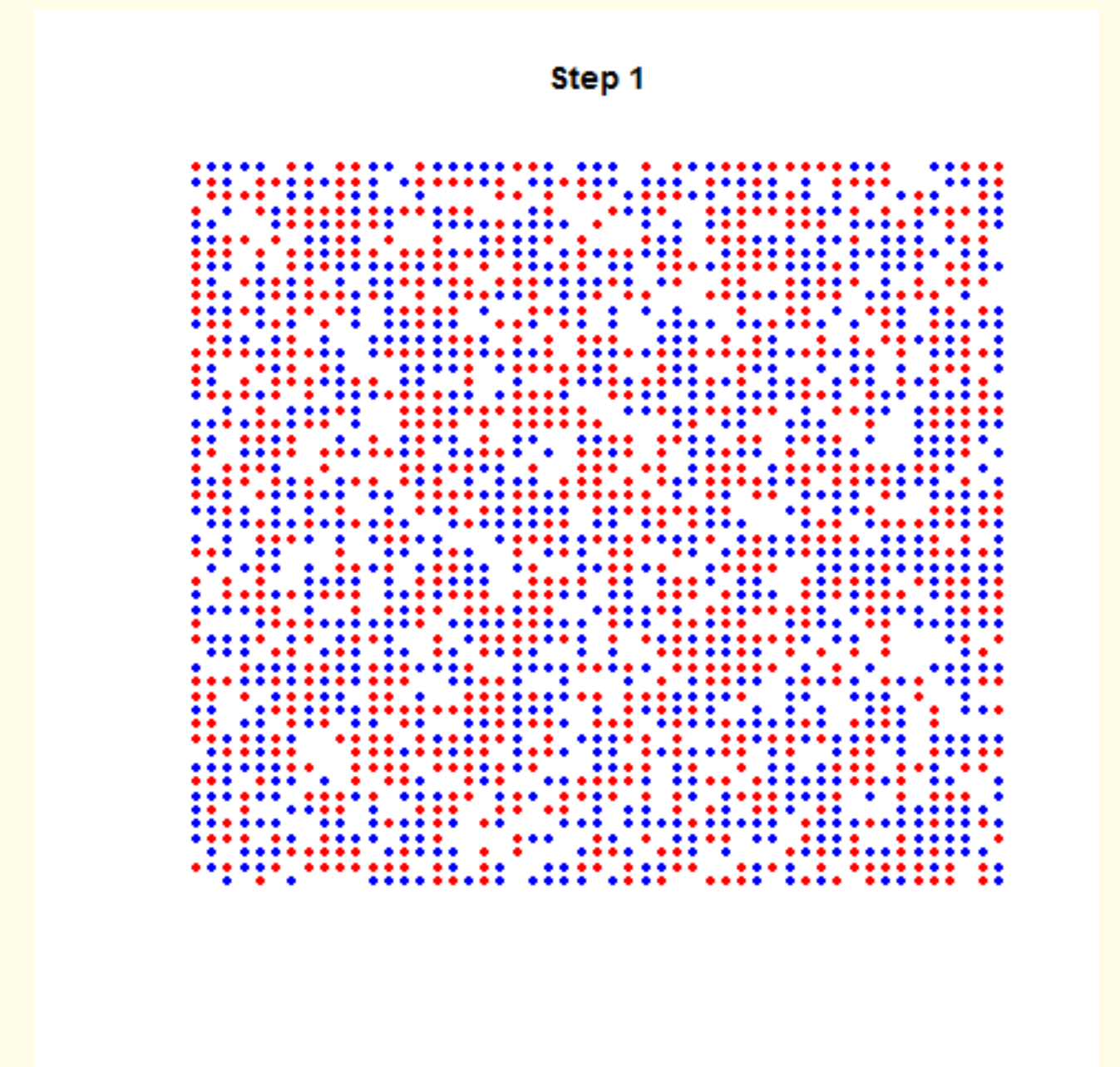


Agent-based models for EIP-1559

<https://ethereum.github.io/abm1559>

Library to simulate the fee market, **abm1559**

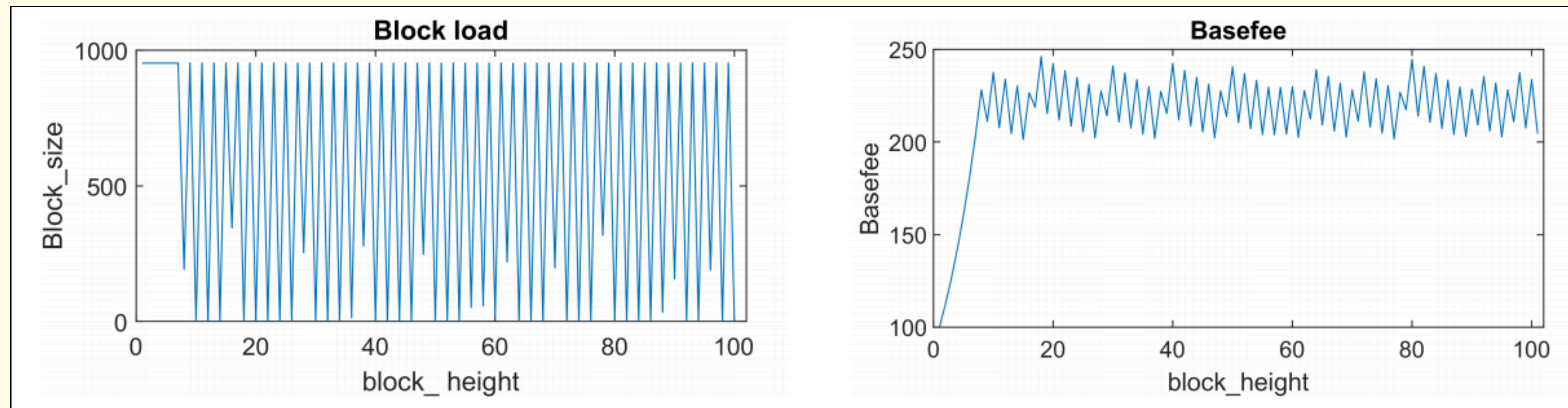
- Code simple behaviours, simulate and observe results!
- Our agents**
 - Users:** Value for the transaction, bidding strategy
 - Block producers:** Transaction pool management, inclusion strategies
- Our environments**
 - Current mechanism, **EIP-1559**, escalator... any mechanism can be implemented!



Imagine → Prove

<https://ethereum.github.io/abm1559>




- 🎨 Simulations clarify emergent phenomena, sometimes reveal unexpected behaviour!
- 🎨 We formalised proofs of EIP-1559 (in)stability in general and boundary cases
- 🎨 Work could prove useful to tune EIP-1559 in the future... but get data first!

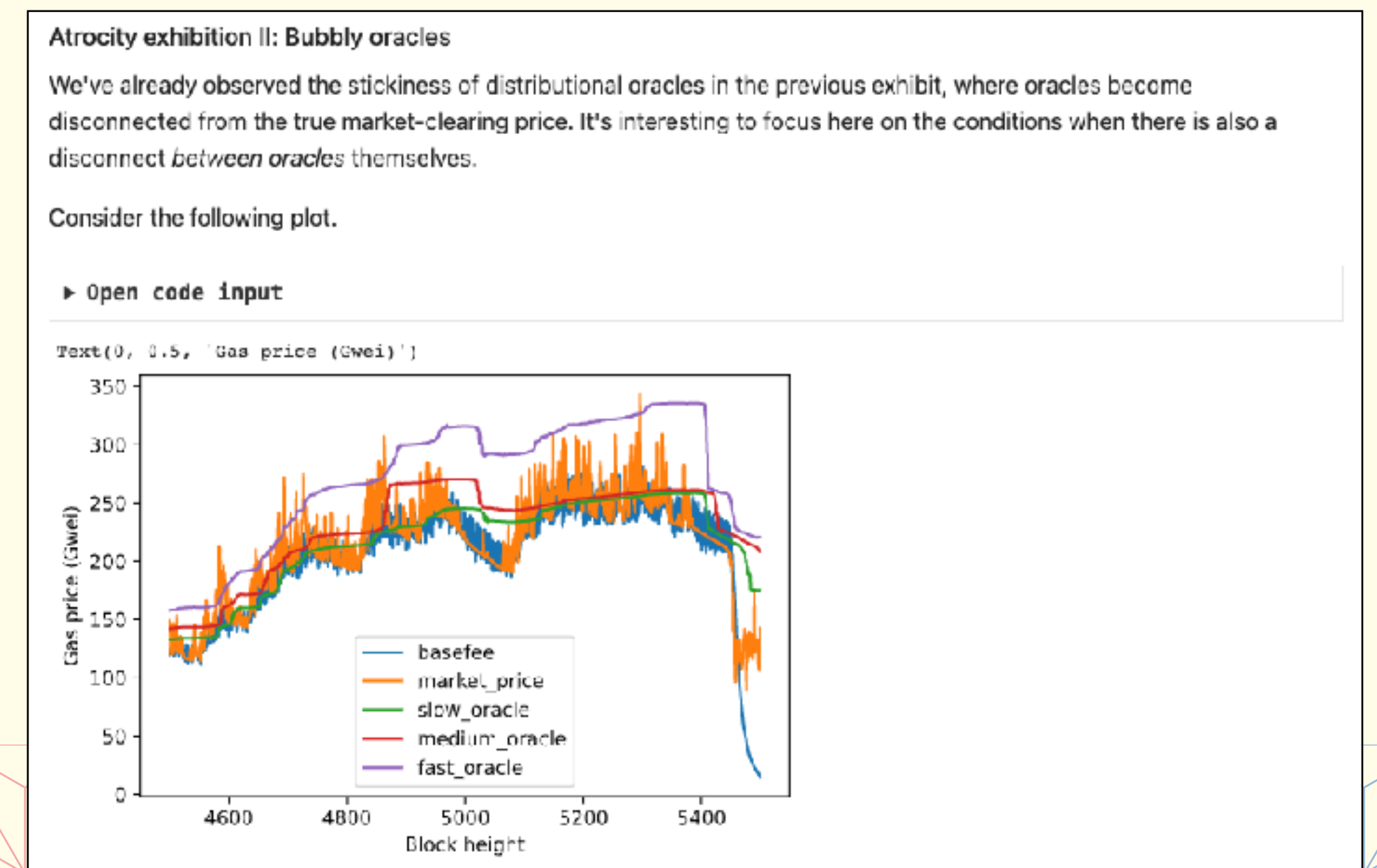
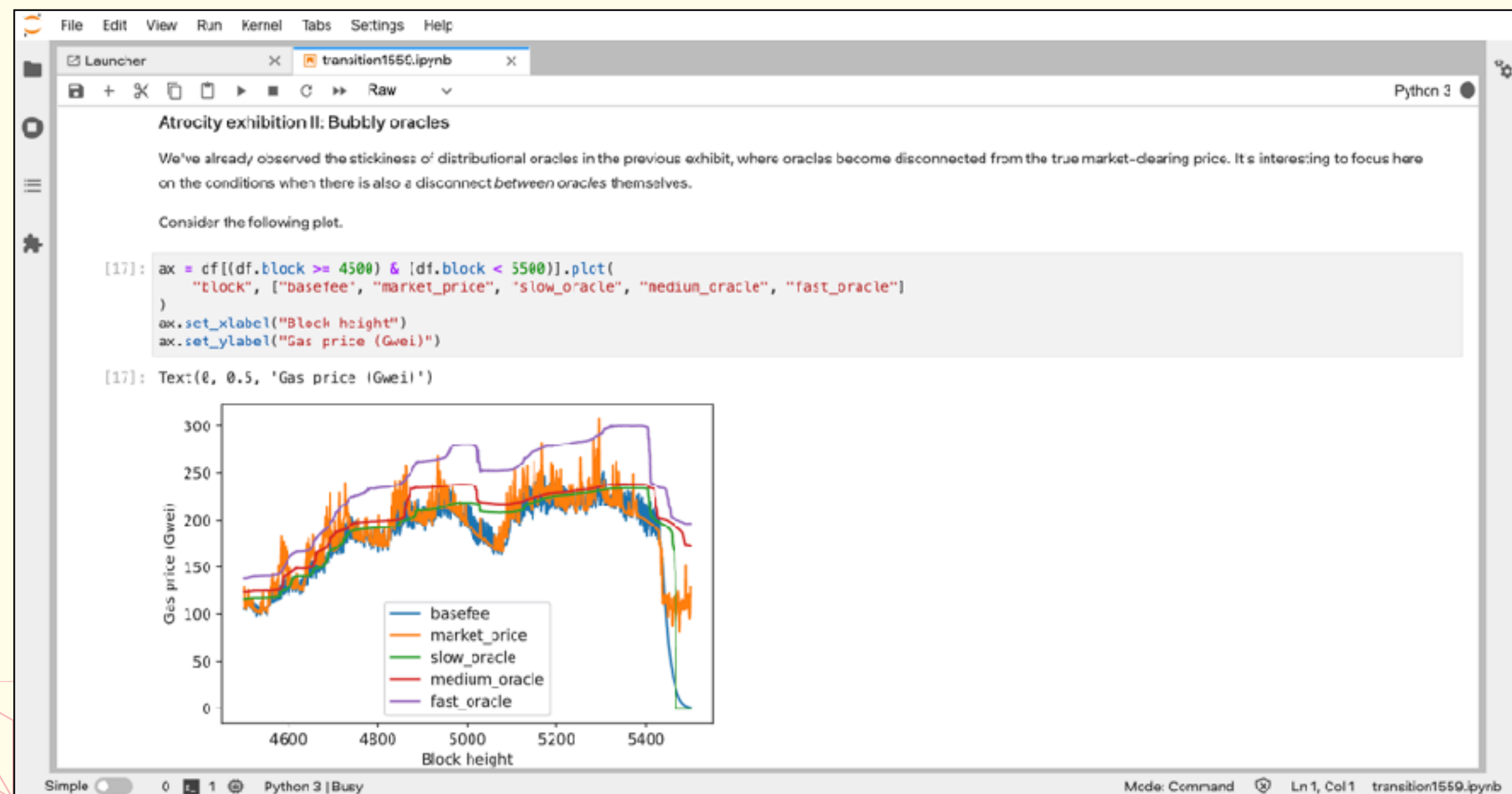


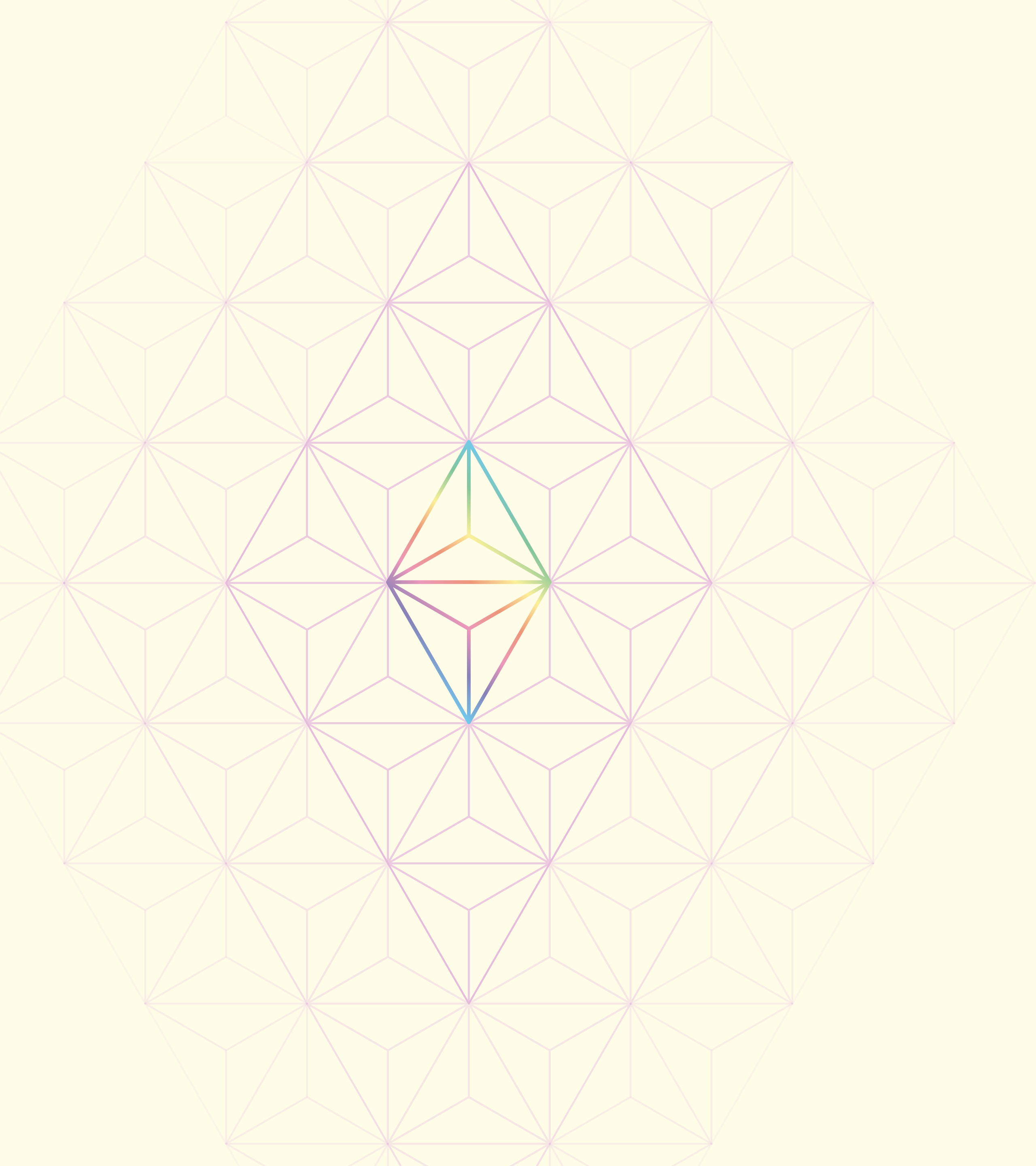
Dynamical analysis of the EIP-1559 Ethereum Fee Market, Leonardos et al., <https://arxiv.org/abs/2102.10567>

Open source, open science

<https://ethereum.github.io/abm1559>

-  Rely on Jupyter Notebooks to provide reproducible results
-  Notebooks exported to reader-friendly formats
-  Community has used the library/notebooks to make their own simulations!










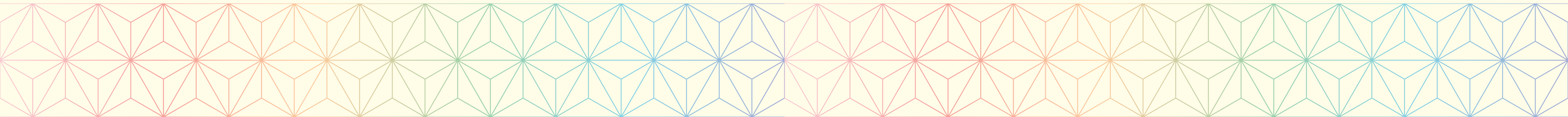


Modelling ~~eth2~~ PoS

Beacon Runner

<https://ethereum.github.io/beaconrunner>

-  Adopt the view of **blockchains as controlled dynamical systems**
-  **State:** A chain of blocks
-  **State update:** Adding a new block to the chain, voting on current blocks
-  **Control:** Users and validators participate in consensus
-  Beacon Runner: Full-fledged simulation environment for validator behaviours
-  Based on the Python PoS executable specs
-  Simulates p2p layer + consensus actions with agent-based methods



Beacon Runner

<https://ethereum.github.io/beaconrunner>

Payoff testing

 Making sure we pay out what we expect to pay out

Strategic testing

 Are there behaviours other than honest that net a higher profit?

Simulating validator rewards in Altair

Authors

Barnabé Monnot

Ethereum Foundation, Robust Incentives Group

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1. How to use
2. Obtaining rewards per duty

1. How to use

In this notebook we test the rewards given out by the protocol to different types of validators. Our `fast` config reduces the size of most constants to avoid allocating more memory than necessary (we'll only test with a few validators). We also reduce the number of slots per epoch to speed things up. All these changes are without loss of generality.

Beacon Runner: Thunderdome

Note: This post describes a result that was true in the v1 specs, but is fixed in the first major upgrade, v1.1, a.k.a. Altair. The table of rewards presented in Section 1. is also outdated. The value of the case study remains.

Authors

Barnabé Monnot

Ethereum Foundation, Robust Incentives Group

Table of contents

1. TL;DR
2. Enter the Thunderdome
 - 2.1 Rewards under consideration
 - 2.2 Attester rewards in PoS Ethereum
 - 2.3 Some hypotheses before simulating
3. "Two nodes enter! One node leaves!"
4. Try it out!
5. (Bonus) Better network

Data analysis

<https://ethereum.github.io/rig/posdata>

New! <https://shsr2001.github.io/beacondigest>



Monitor beacon chain metrics



Study dynamics as they play out



Diagnose issues

Exploring the first 1000 epochs of eth2

Mr. F was here. And many more too.

AUTHOR	AFFILIATION	PUBLISHED
Barnabé Monnot	Robust Incentives Group, Ethereum Foundation	Dec. 7, 2020

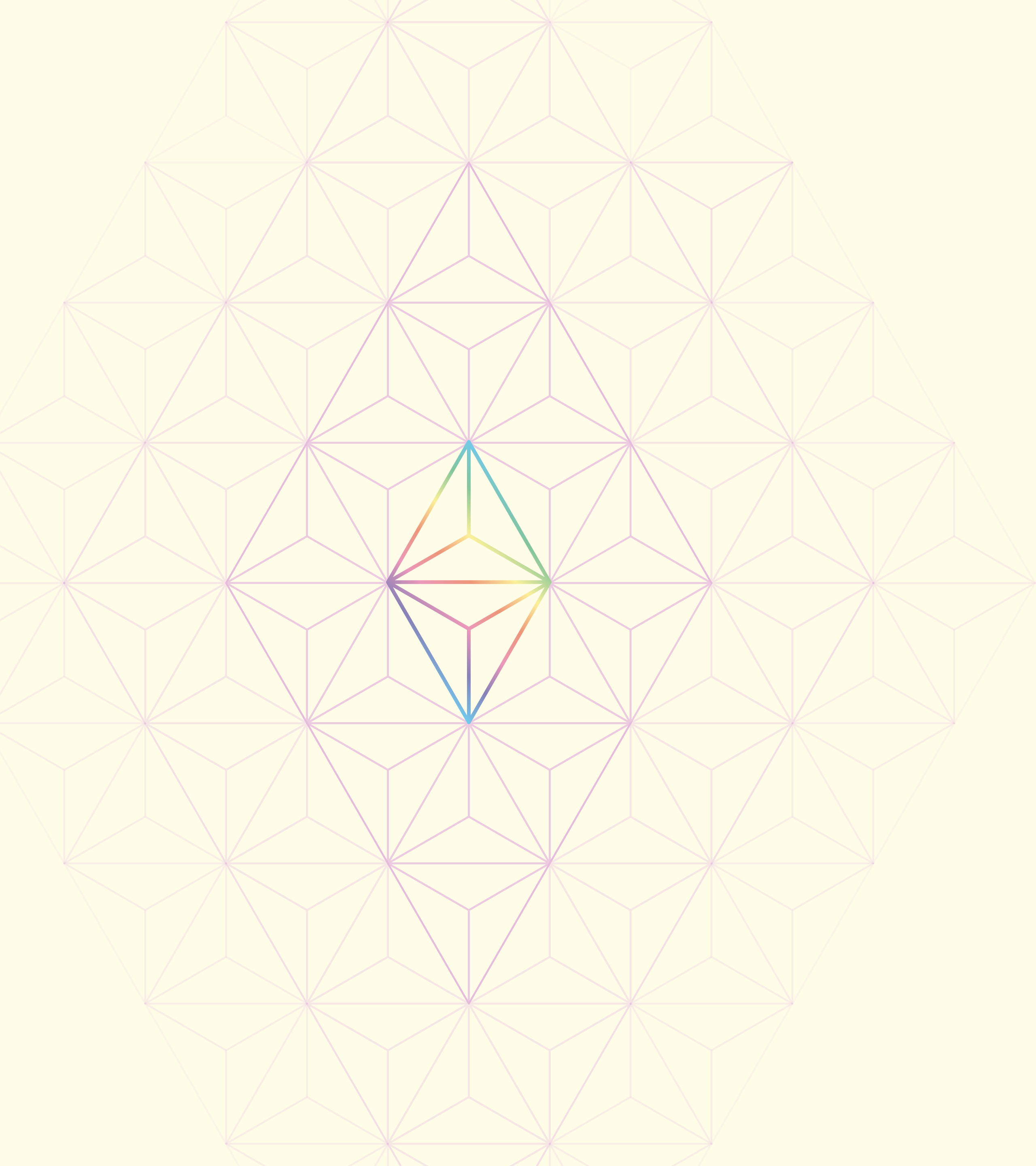
Oceanic games in PoS Ethereum

Authors

Shyam Sridhar
Ethereum Foundation, Robust
Incentives Group

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1. An Introduction to Oceanic Games
2. Introducing the Oceanic Games Model
3. Analysis
 - 3.1 Limitations of the Notebook
4. The Beacon Chain Digest - June 8th
 - 4.1 Attester and proposer slashing
 - 4.2 Proposed blocks count
 - 4.3 Participation rate
 - 4.4 Exit counts
 - 4.5 Deposit counts

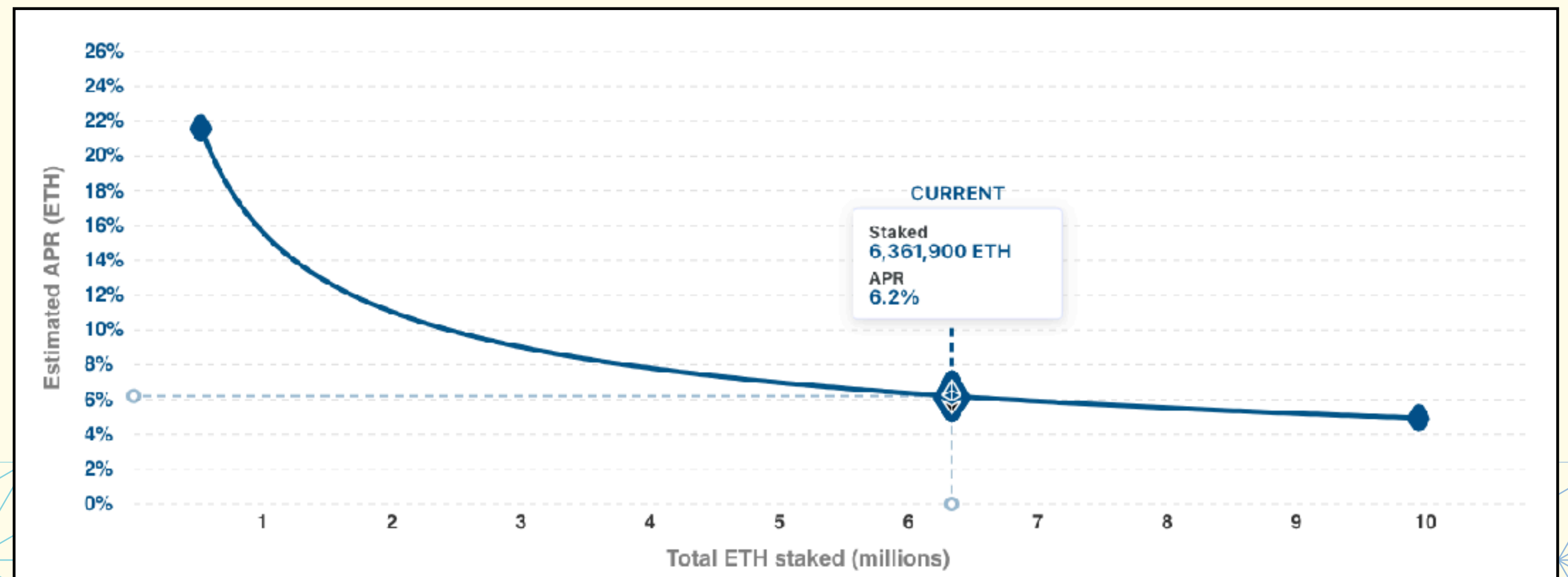
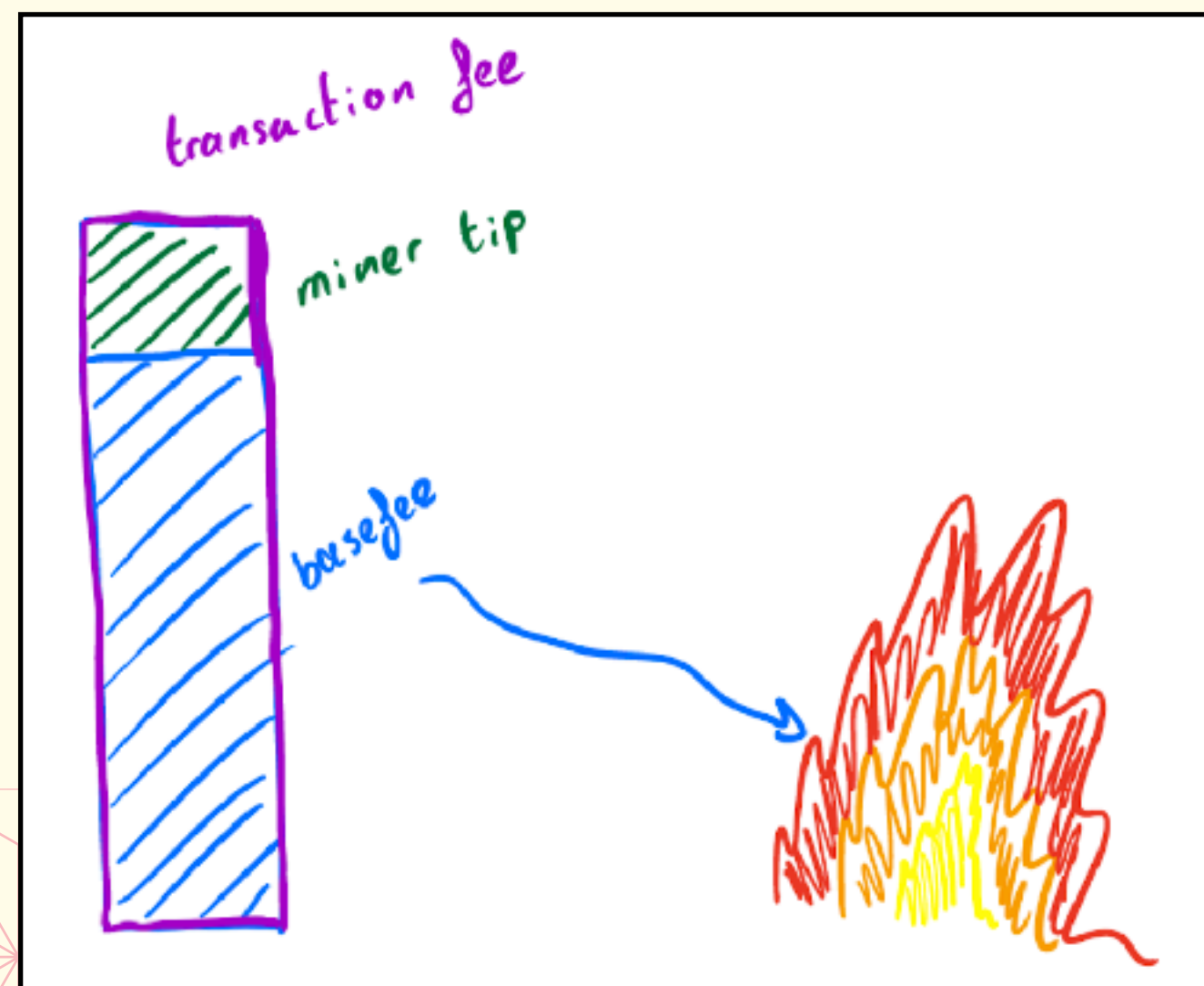


Modelling Ethereum economics

Future economics

- 🎨 EIP-1559 adds a sink to the ETH asset
- 🎨 Basefee paid by users is burned (removed from supply)
- 🎨 Proof-of-Stake considerably reduces the cost of securing Ethereum
- 🎨 Issuance reduced almost ten-fold compared with Proof-of-Work


<https://launchpad.ethereum.org>



Open modelling

- Ethereum is a **complex economic system**, critical to model long-term effects and analyse impact scenarios + economic interactions
- Community has already developed some of their own models!




Pintail's Notes



Beacon Chain Validator Rewards
🕒 21 minute read

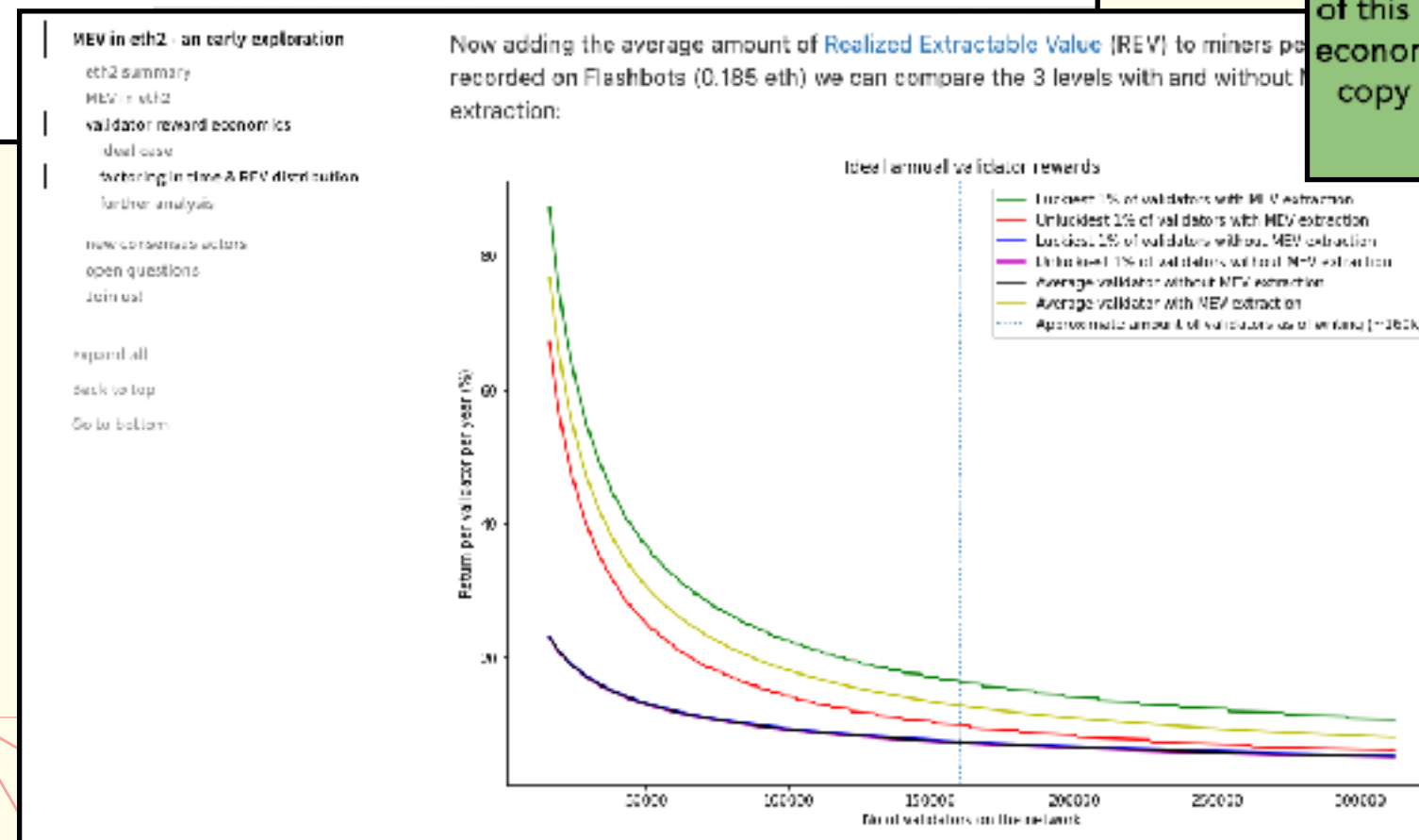
How Much Can I Earn?

pintail
Twitter
GitHub



Telegram: @eth2calculator
Telegram: @StakeETH

Hey Everyone! Welcome to the official eth2 Calculator. The purpose of this calculator is to increase transparency and discovery around the economics of eth2. This model is 100% open source so please make a copy and begin experimenting with it on your own. If you have any questions please DM me directly @StakeETH.



Ethereum 2.0 Economic Review

An Analysis of Ethereum's Proof of Stake Incentive Model

 Tom Borgers Jul 17, 2020 · 6 min read

By Tanner Hoban and Tom Borgers. Both authors work in Corporate Development at ConsenSys. This report was an independent research effort to review the network economics of Ethereum 2.0 spec v0.12.

rocketpool-research / Analysis.md

jclapis Small fixes, added links between sections

1 contributor

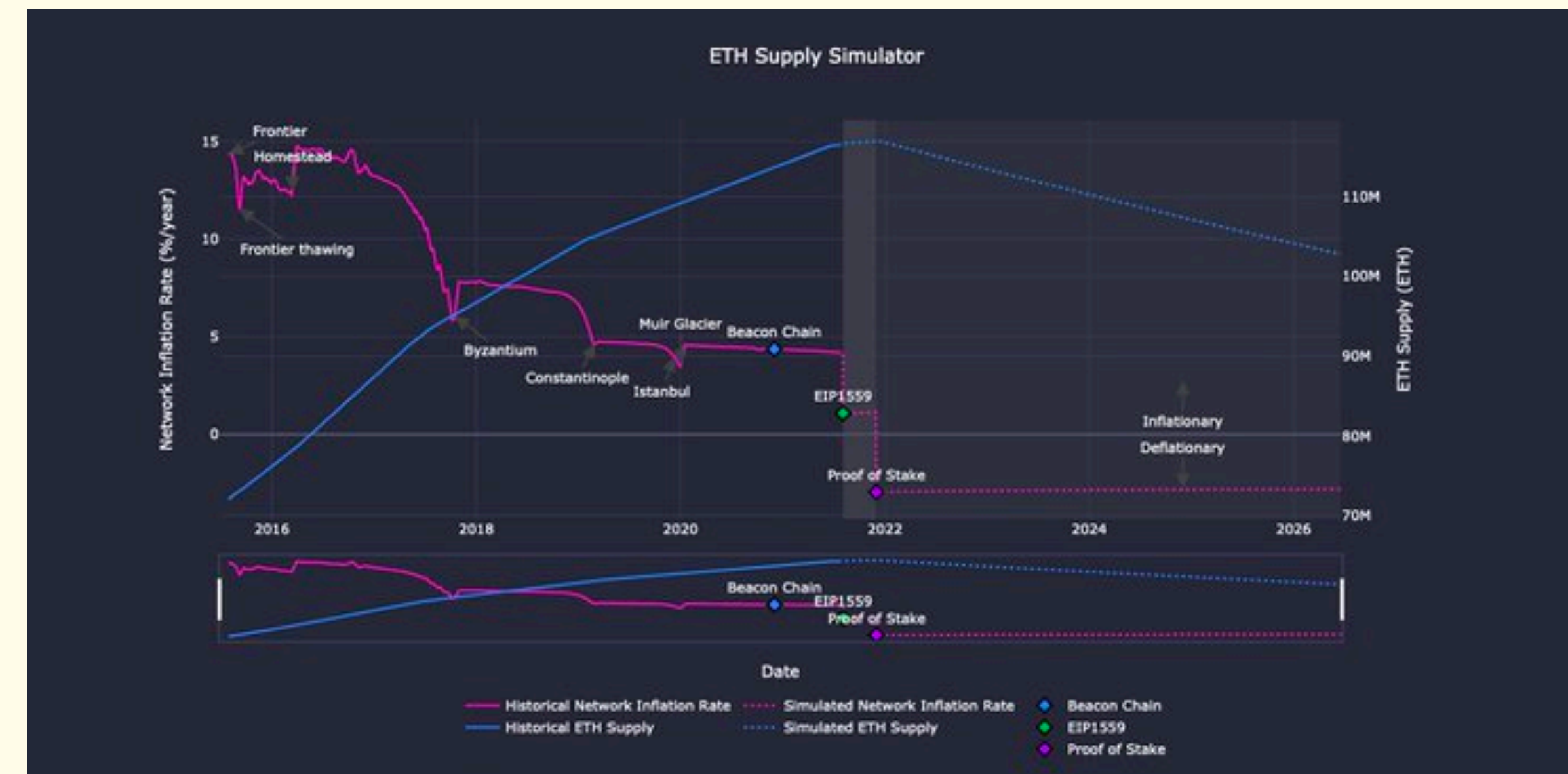
136 lines (96 sloc) 11.7 KB

Post-Merge APY Analysis

CADLabs Ethereum economic model

Python-based model for basic protocol dynamics

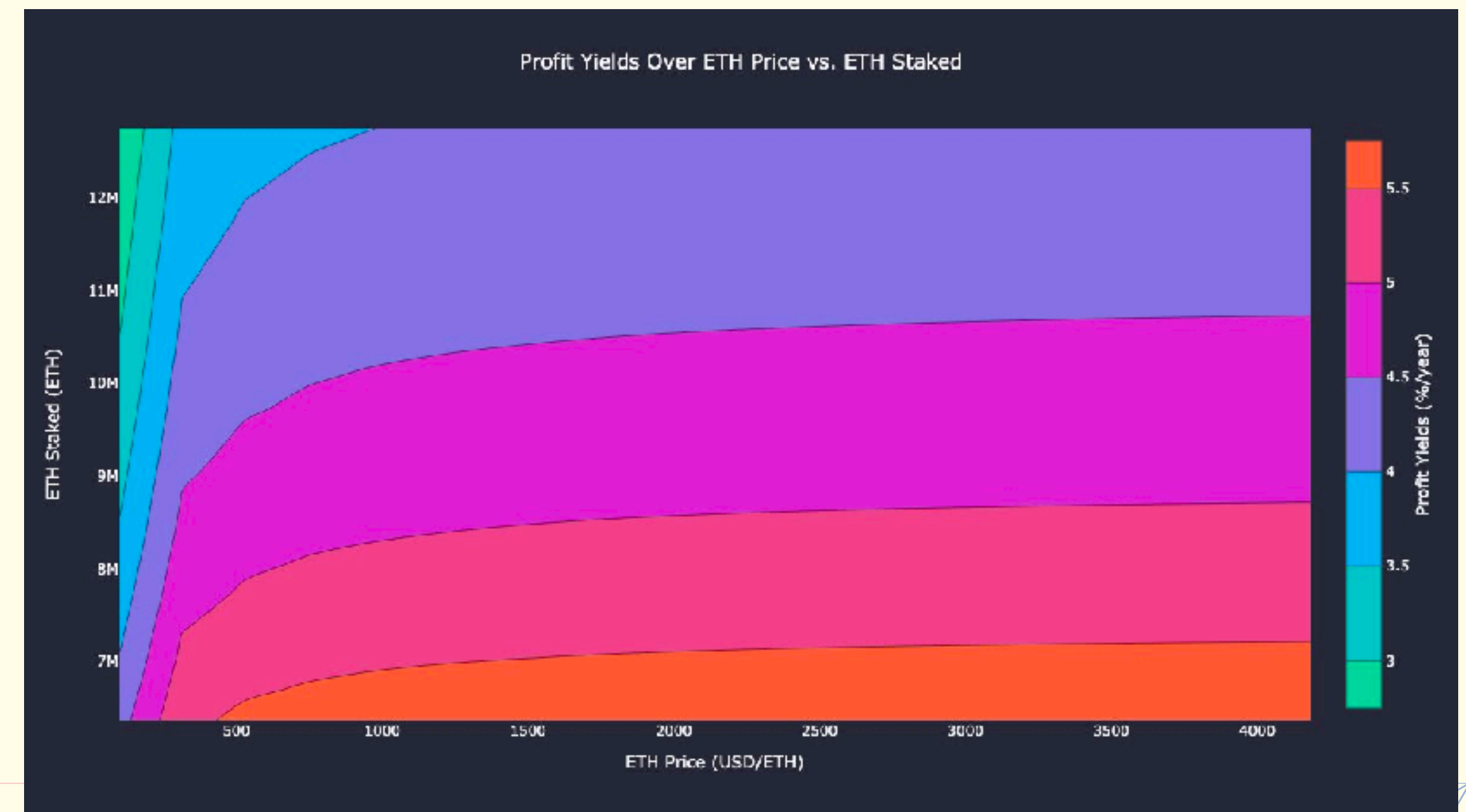
- 🎨 PoS validator rewards/costs, EIP-1559 fee market, validator adoption, price models
- 🎨 Designed for modularity and extensibility
- 🎨 Fully documented + Notebooks available
- 🎨 Built on cadCAD / radCAD
- 🎨 **Online masterclass to follow**
Learn about PoS and use the model



Try it out!

Call to action

- Find the repo at <https://github.com/cadlabs/ethereum-economic-model>
- Model overview and contact: [@CADLabs_org](https://twitter.com/CADLabs_org)
- Or find me on Twitter, [@barnabemonnot](https://twitter.com/barnabemonnot)



Enjoy Paris!

Thank you for tuning in!

<https://ethereum.github.io/rig>

Me when I pronounce "croissant" like
quâssòñ

