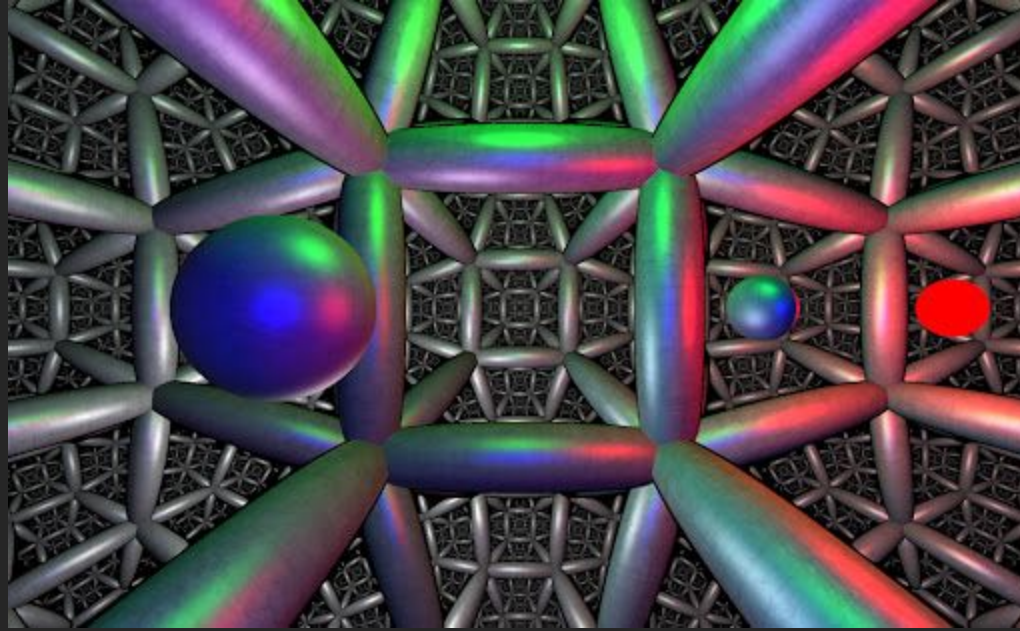
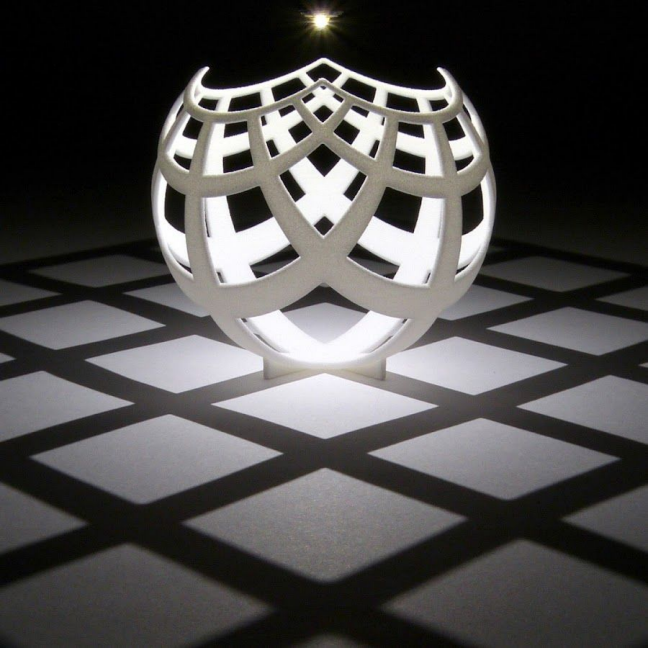




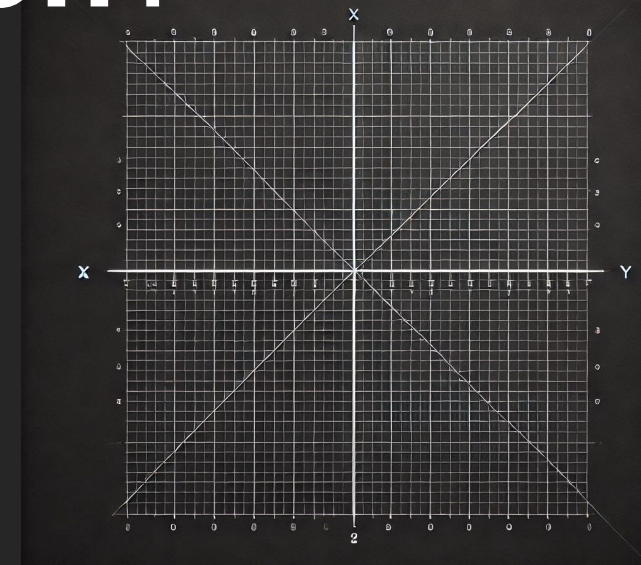
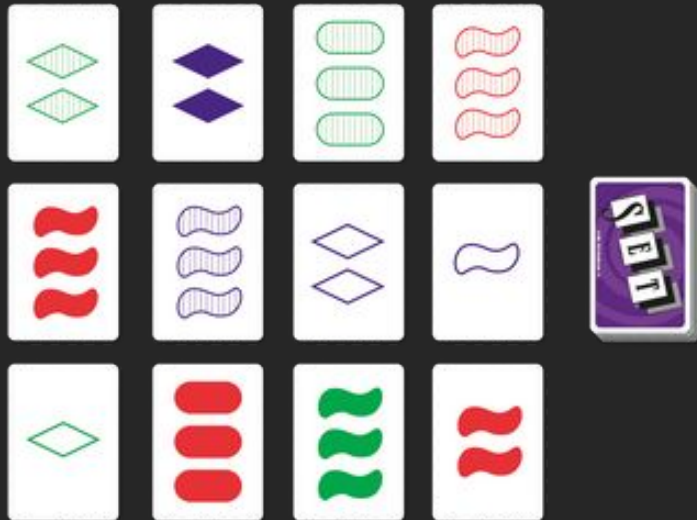
A collection of "proofs" for: The importance of Illustration for Mathematical Research

Martin Skrodzki

Computer Graphics and Visualization
Delft University of Technology



What is (math) illustration?



We will prove the importance of illustrations by ...

- Reference
- Authority
- Picture
- Example
- Curiosity

Proof by ... Reference

Coulon, Rémi, et al. "On the importance of illustration for mathematical research." *Notices of the American Mathematical Society* 71.1 (2023).

q.e.d.

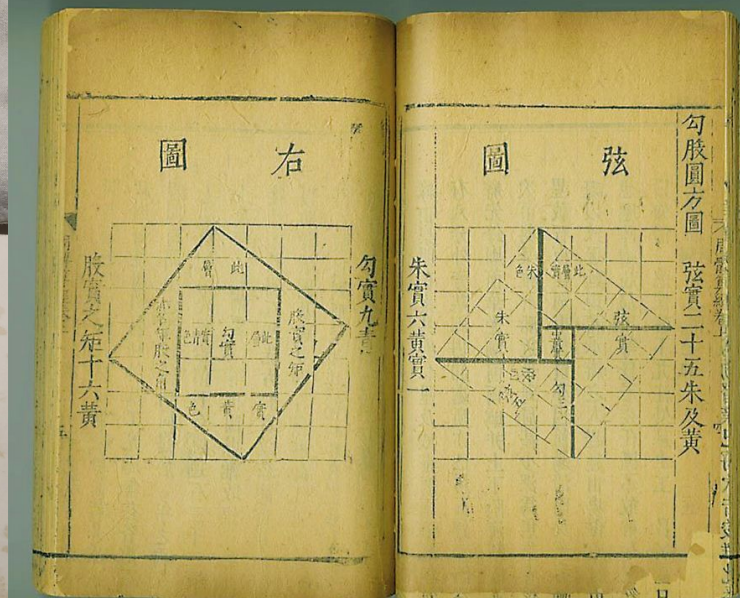
On the importance of illustration for mathematical research, Notices of the AMS, 2023



Blombos Cave, 71,000 BCE

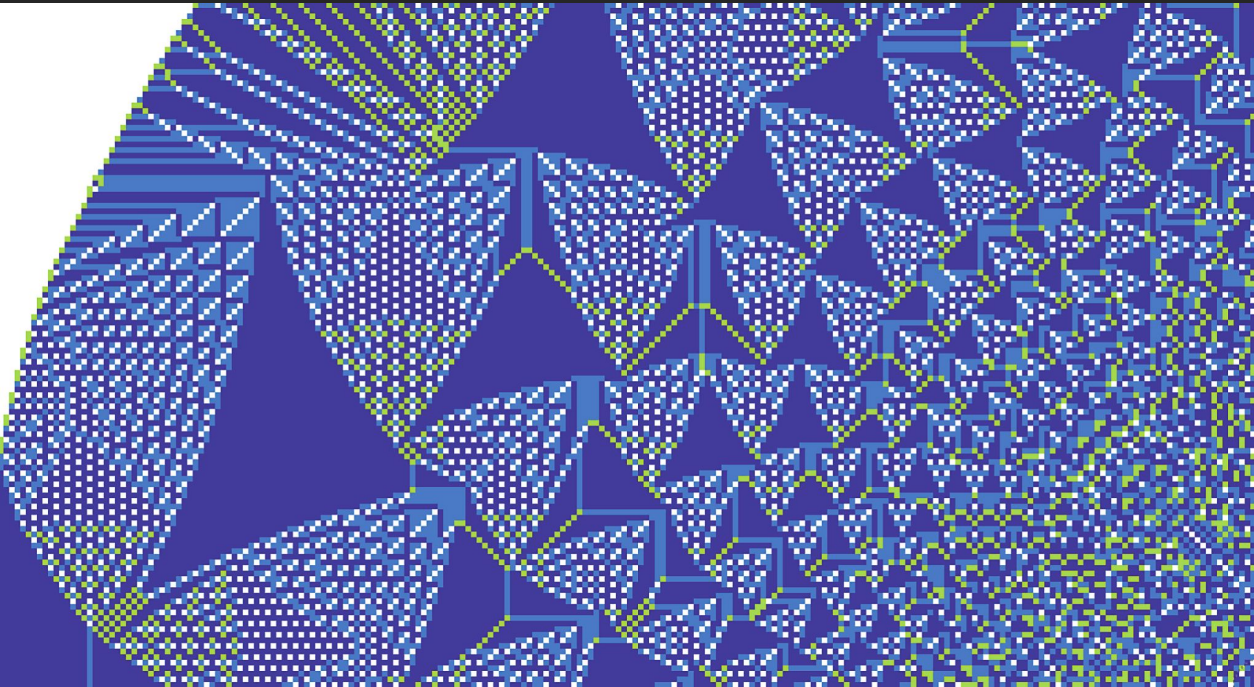


Elements, Byrne, 1847

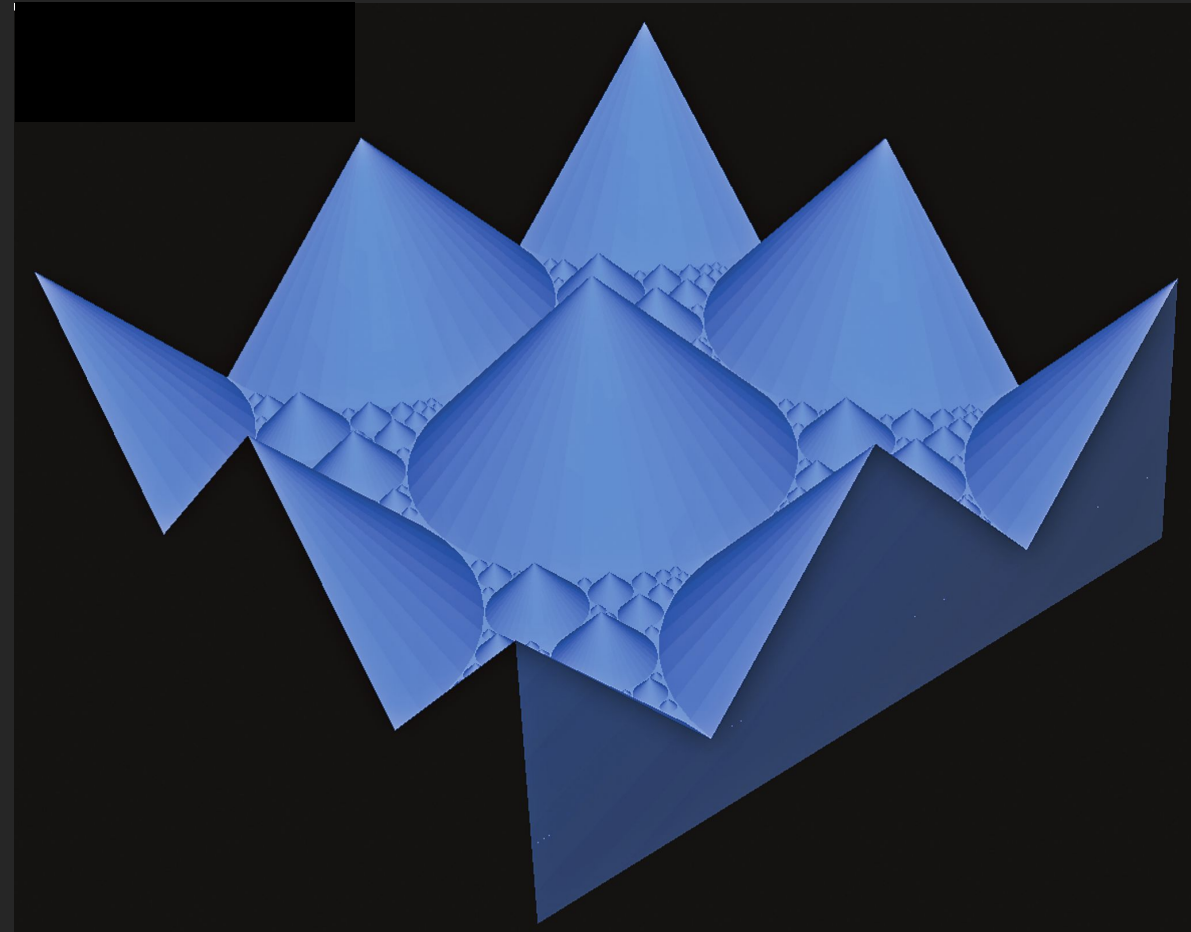


Nine Chapters on the Mathematical Art

On the importance of illustration for mathematical research, Notices of the AMS, 2023

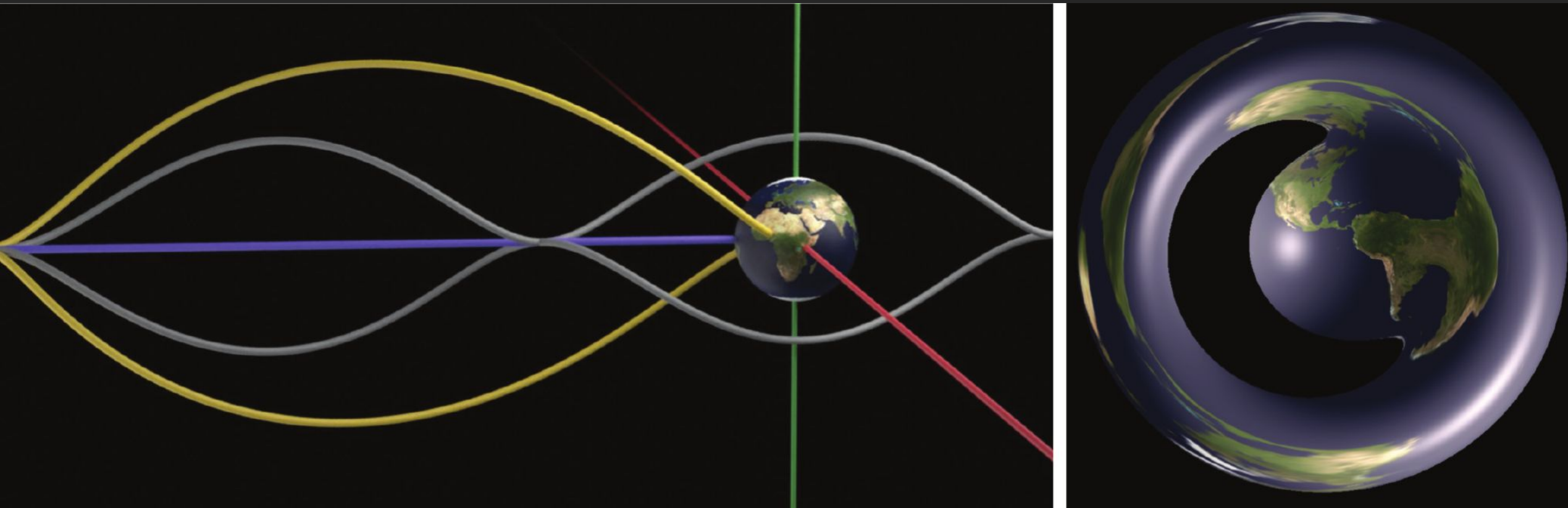


Abelian Sandpile



Matrices

On the importance of illustration for mathematical research, Notices of the AMS, 2023



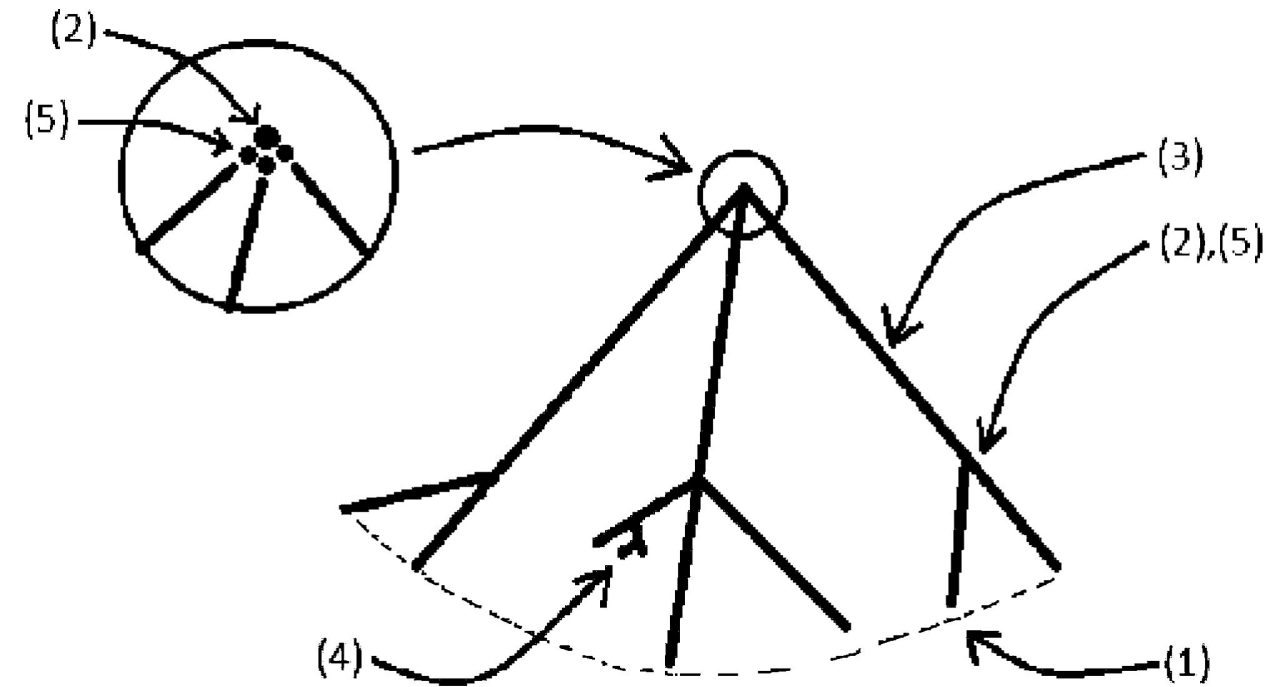
Matei P. Coiculescu and Richard Evan Schwartz, The spheres of Sol, *Geom. Topol.* 26 (2022), no. 5, 2103–2134

Proof by ... Authority*†

* subject to who you recognize as authority

† hopefully you count Fields medallists

On the importance of illustration for mathematical research, Notices of the AMS, 2023



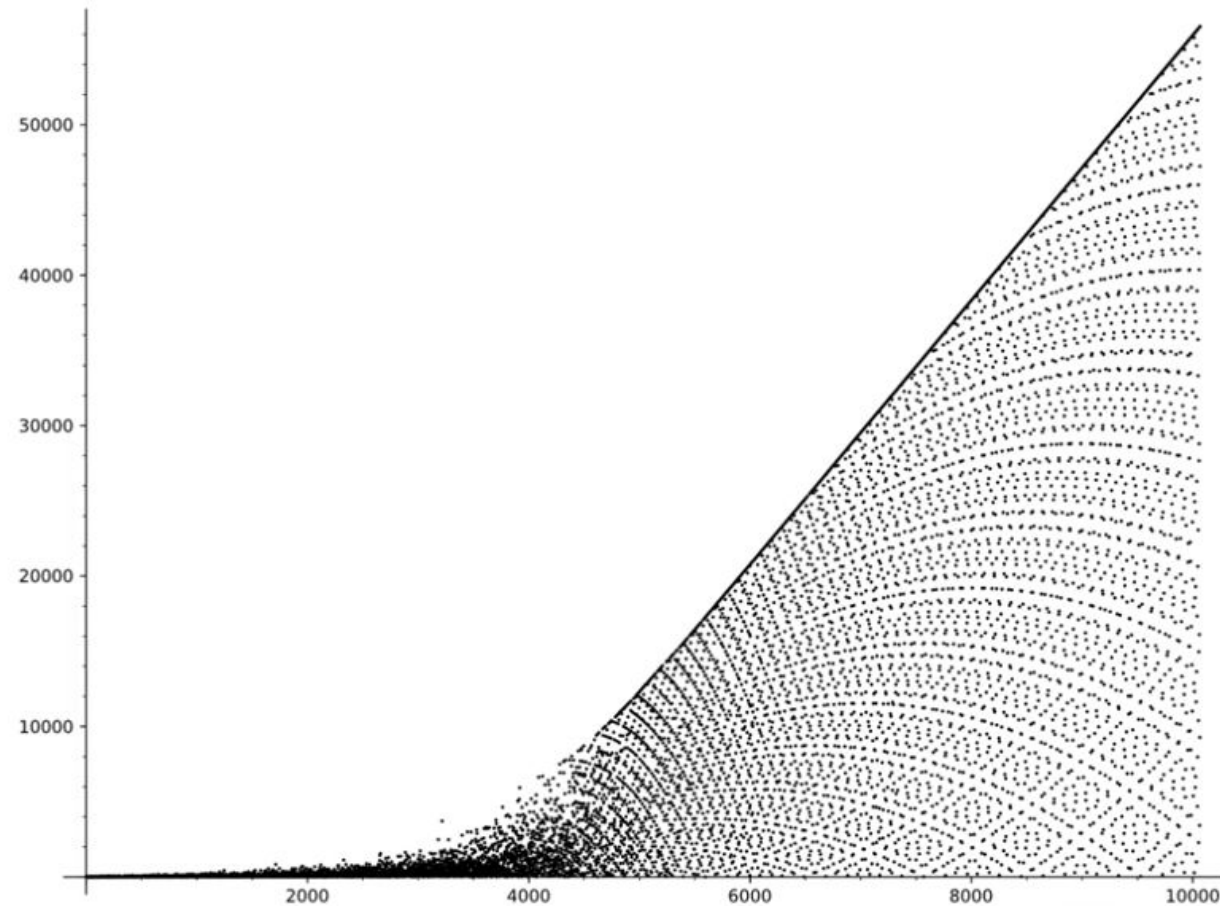
Peter Scholze, Perfectoid spaces, Publ. Math. Inst. Hautes Études Sci. 116 (2012), 245–313



Allen Knutson, Terence Tao, and Christopher Woodward, The honeycomb model of GL_n (©) tensor products. II. Puzzles determine facets of the Littlewood-Richardson cone, J. Amer. Math. Soc. 17 (2004), no. 1, 19–48

Proof by ... Picture

differences between successive missing curvatures



Between Illustration and Research in Number Theory



Illustrating Math Seminar
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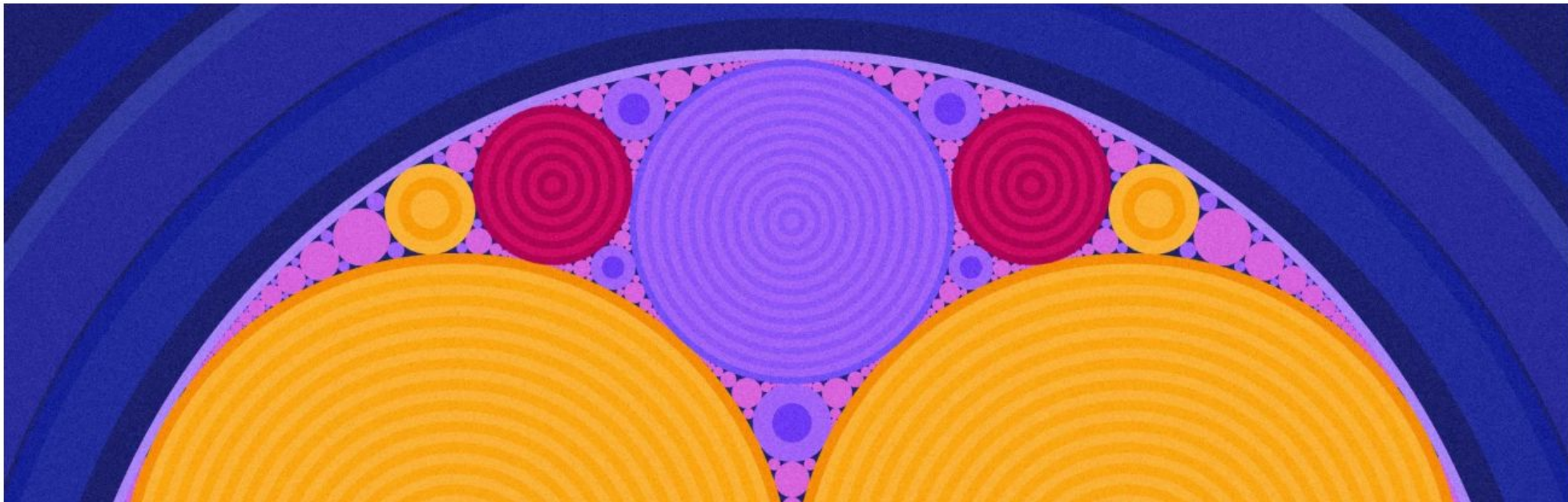


NUMBER THEORY

Two Students Unravel a Widely Believed Math Conjecture

7 | 📄

Mathematicians thought they were on the cusp of proving a conjecture about the ancient structures known as Apollonian circles. But a summer project would lead to its downfall.



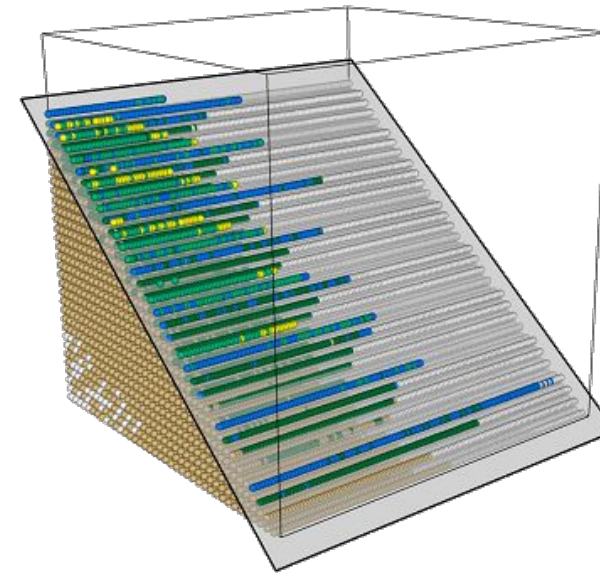
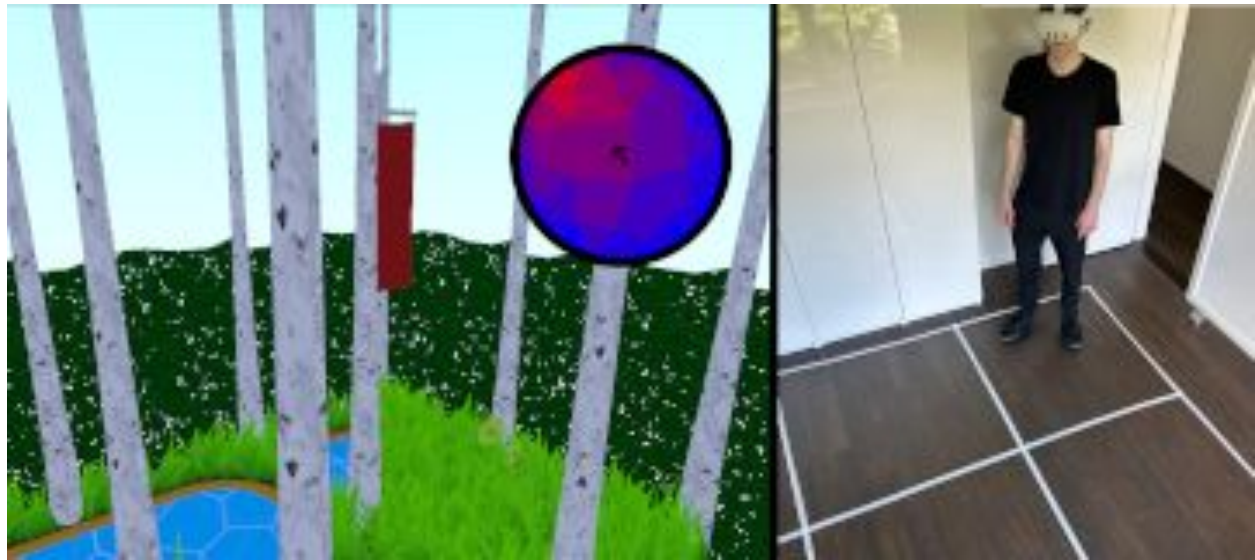
Katherine Stange named 2025-26 AMS Birman Fellow

📅 12/5/2024

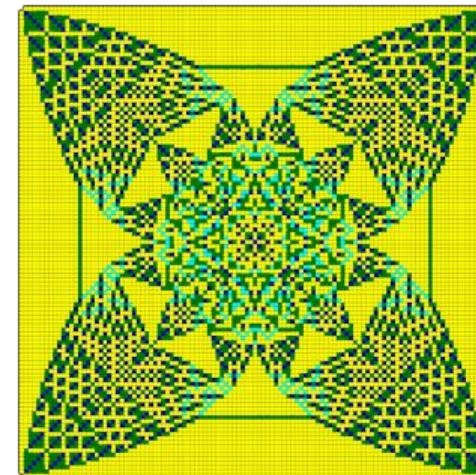
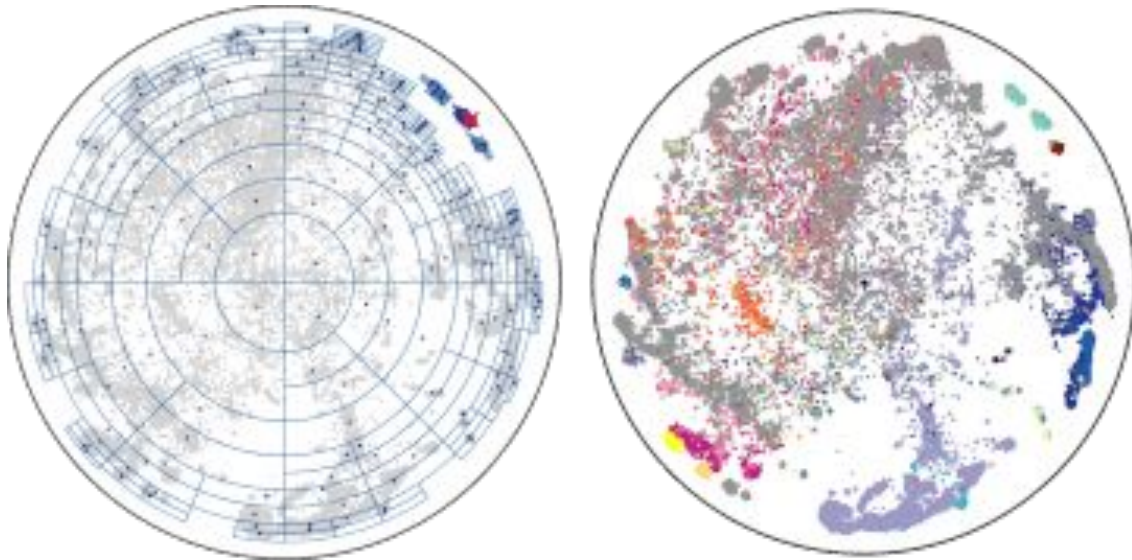


Katherine Stange has been named the 2025-26 AMS Joan and Joseph Birman Fellow.

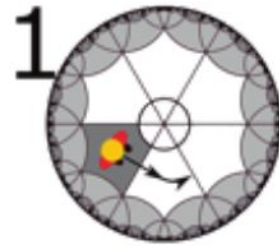
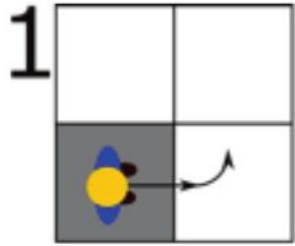
This award supports her outstanding research in number theory. Congratulations Kate!



Proof by ... Example / Curiosity

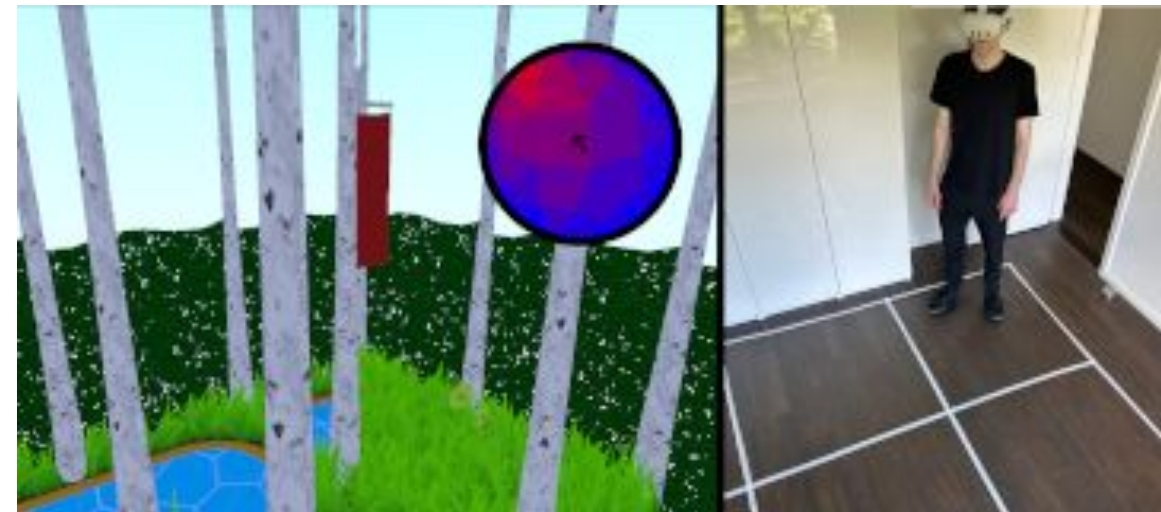


Example: Holonomy VR

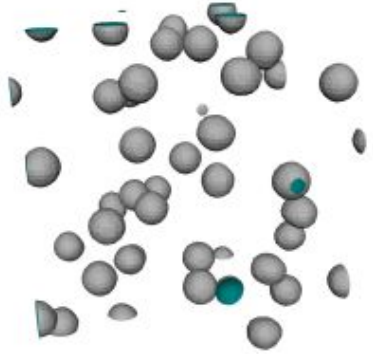
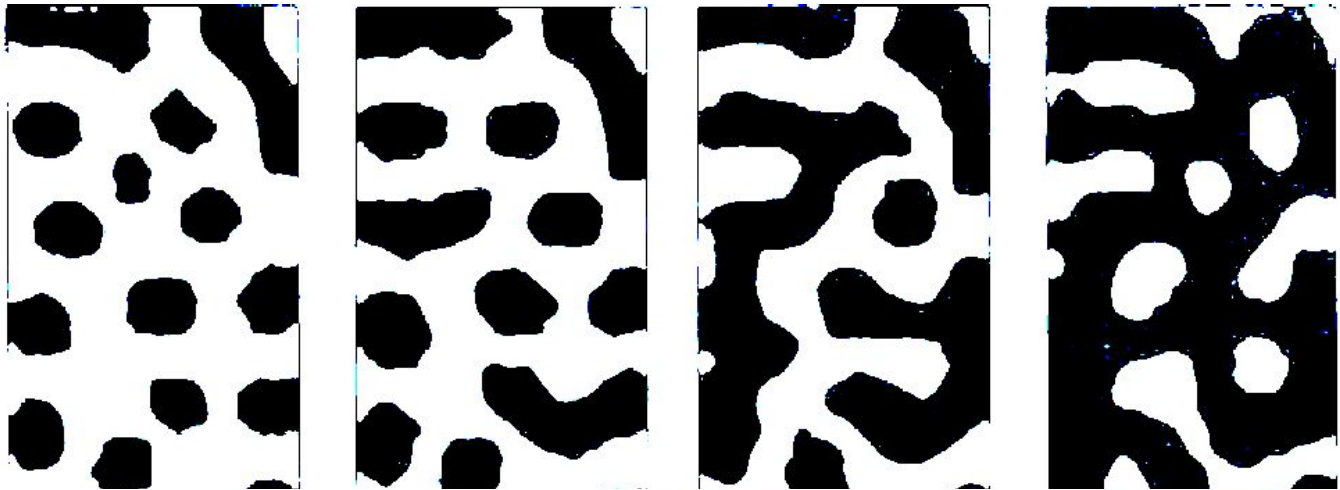


More Information

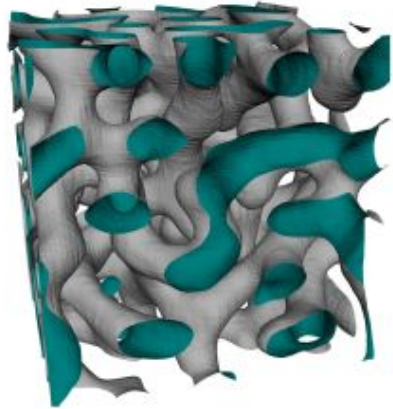
- M. Skrodzki et al., “Holonomy: A Virtual Environment based on Hyperbolic Space”, Proceedings of Web3D, 2024.
- M. Skrodzki, “Illustrations of non-Euclidean geometry in virtual reality”, 2021.
- V. Hart et al., “Non-euclidean Virtual Reality II: Explorations of $\mathbb{H}^2 \times \mathbb{E}$ ”, 2017.
- H. Segerman, “Non-euclidean virtual reality”, <https://www.youtube.com/watch?v=ztsi0CLxmjw>.



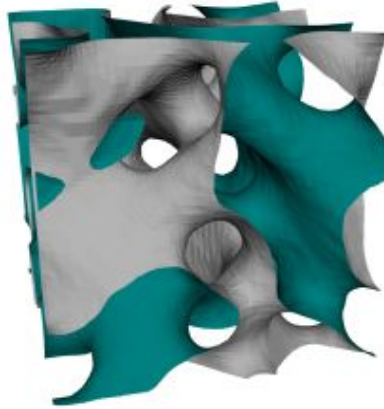
Example: 3D Turing-like patterns



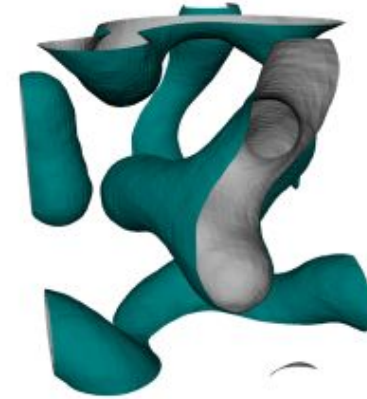
(a) DC spheres ■



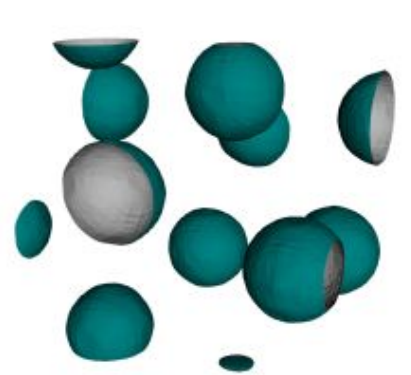
(b) DC pipes ■



(c) areas ■



(d) UC pipes ■

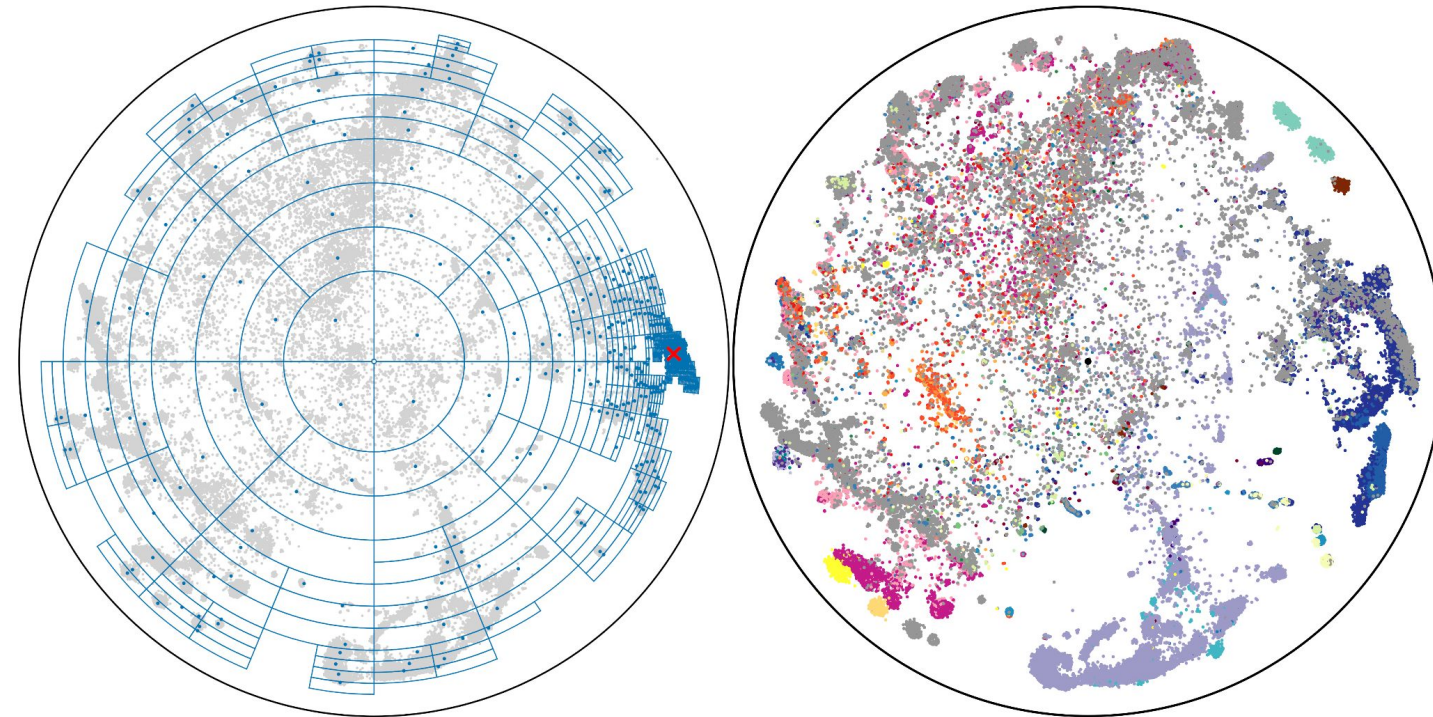


(e) UC spheres ■

More Information

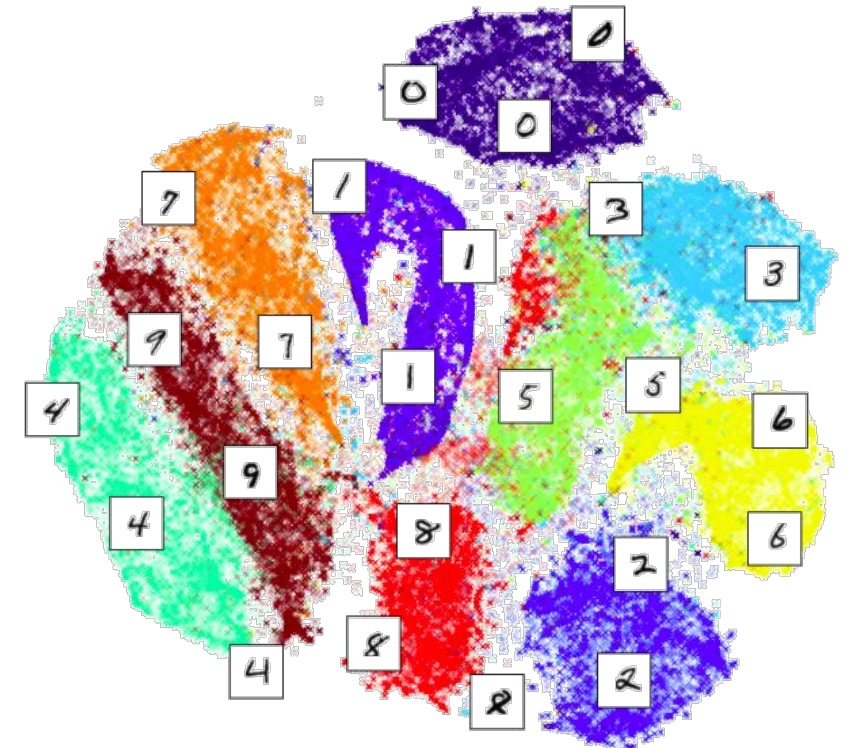
- M. Skrodzki, E. Zimmermann, and U. Reitebuch. “Experimental visually-guided investigation of sub-structures in three-dimensional Turing-like patterns”, Exploratory Papers of Automata 2021.
- M. Skrodzki and K. Polthier, “Turing Patterns Revisited: A Peek Into The Third Dimension”, Proceedings of Bridges, 2017.

Example: Hyperbolic t-SNE

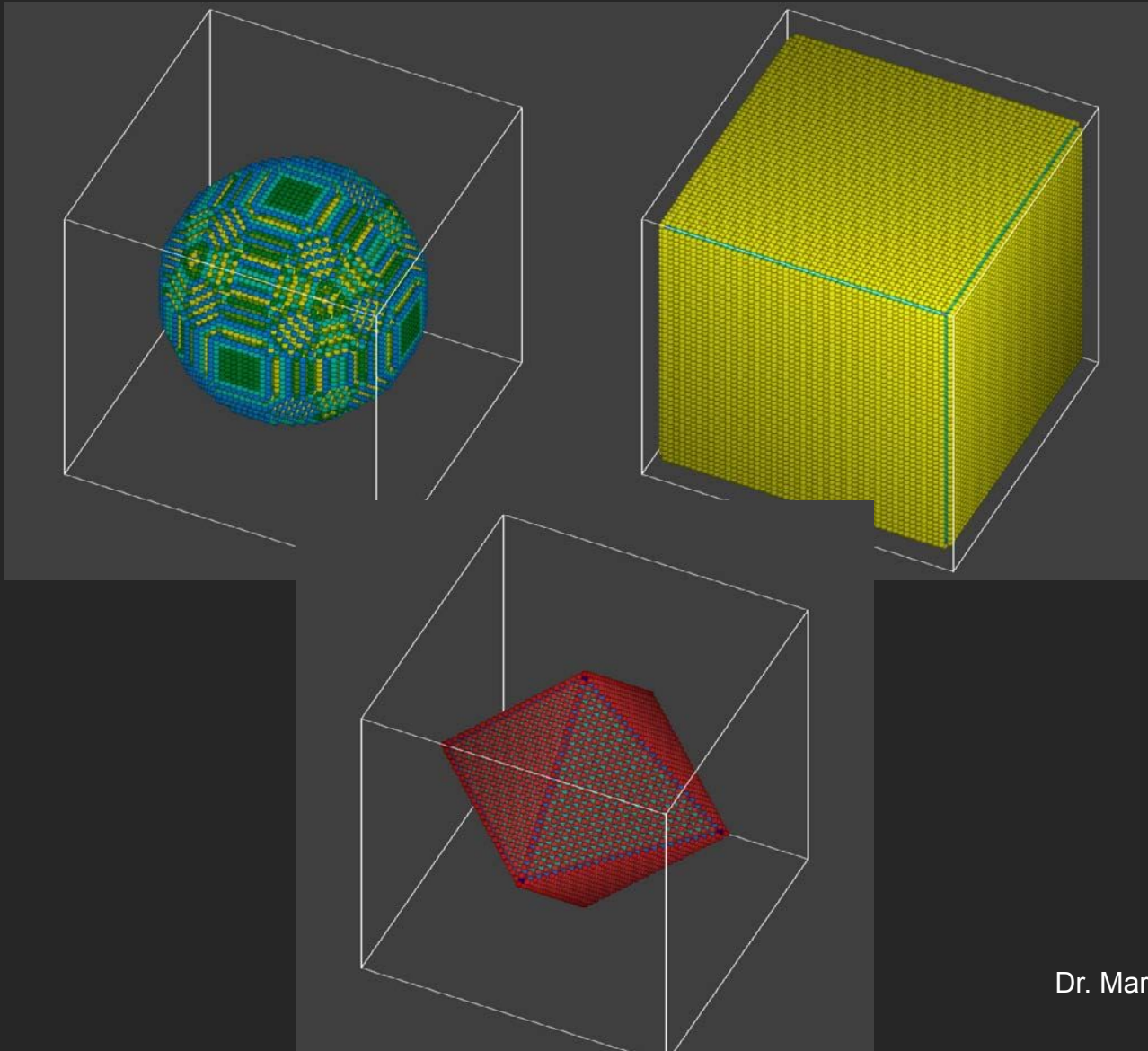


More Information

- M. Skrodzki et al., "Accelerating hyperbolic t-SNE", TVCG, 2024.
- L. Van der Maaten and G. Hinton. "Visualizing data using t-SNE." Journal of machine learning research 9.11 (2008).

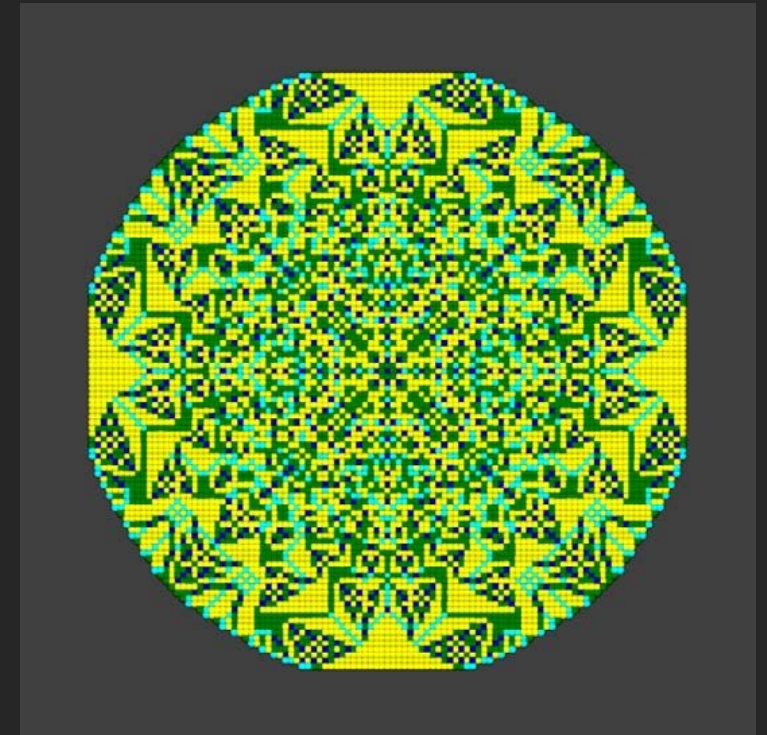


Example: 3D Chip Firing



More Information

- M. Skrodzki and U. Reitebuch, “Chip-Firing Revisited: A Peek into the Third Dimension”, Proceedings of Bridges 2022.



What's next for illustrating mathematics?

- <https://bridgesmathart.org>, Eindhoven 2025!
- Journal of Mathematics and the Arts
- <https://illustratingmath.org/>
 - Discord Server
 - Seminar
- Community Events:
 - Summer '25: ICERM
 - Spring '26: IHP

