From the Hype-Shape Conjecture to CUT-i

A clean narrative with equations restored and text sanitized

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1. The Hype-Shape Conjecture

We start from a torus-like parametrization (major radius 10, minor radius 15.85). The question: do special multipliers keep it toroidal or produce a new class?

$$\mathrm{HypeShape}(\phi,\psi,t)=((10+15.85\cos\psi)\cos\phi,\ (10+15.85\cos\psi)\sin\phi,\ 15.85\sin\psi)$$

Baseline Hype-Shape embedding.

$$G\sim\{+1,-1,0,\ \pm\pi,\ \pm i,\ \pm\pi^2,\ \pm i^2\}$$

Operator set G acting by multiplication on the parametrization.

2. Why this leads to redefining i

Real multipliers live inside R^3. Multiplying by i does not; it suggests a quarter-turn in a complex plane. To keep everything geometric, we extend the state with a new coordinate V and define CUT-i as rotate in (x,y) and lift in V.

$$i(x,y,z,t,V) = \left(-y,\ x,\ z,\ t,\ V + \lambda\sqrt{x^2 + y^2}\right)$$

CUT-i: rotate in (x,y), lift along V by lambda times radius in the plane.

$$i^{-1}(x,y,z,t,V) = \left(y,\ -x,\ z,\ t,\ V - \lambda\sqrt{x^2 + y^2}\right)$$

Inverse CUT-i undoes both rotation and lift.

$$i^{-1} \circ i = \mathrm{Id}$$

Chaining i and i^-1 yields identity on position; radius in the plane is invariant.

3. Continuous picture

As a flow: rotate at angular speed omega while V increases with planar radius and relaxes with damping mu.

$$\dot{x} = -\omega y,\ \dot{y} = \omega x,\ \dot{z} = 0,\ \dot{V} = \pm\kappa\sqrt{x^2 + y^2} - \mu V$$

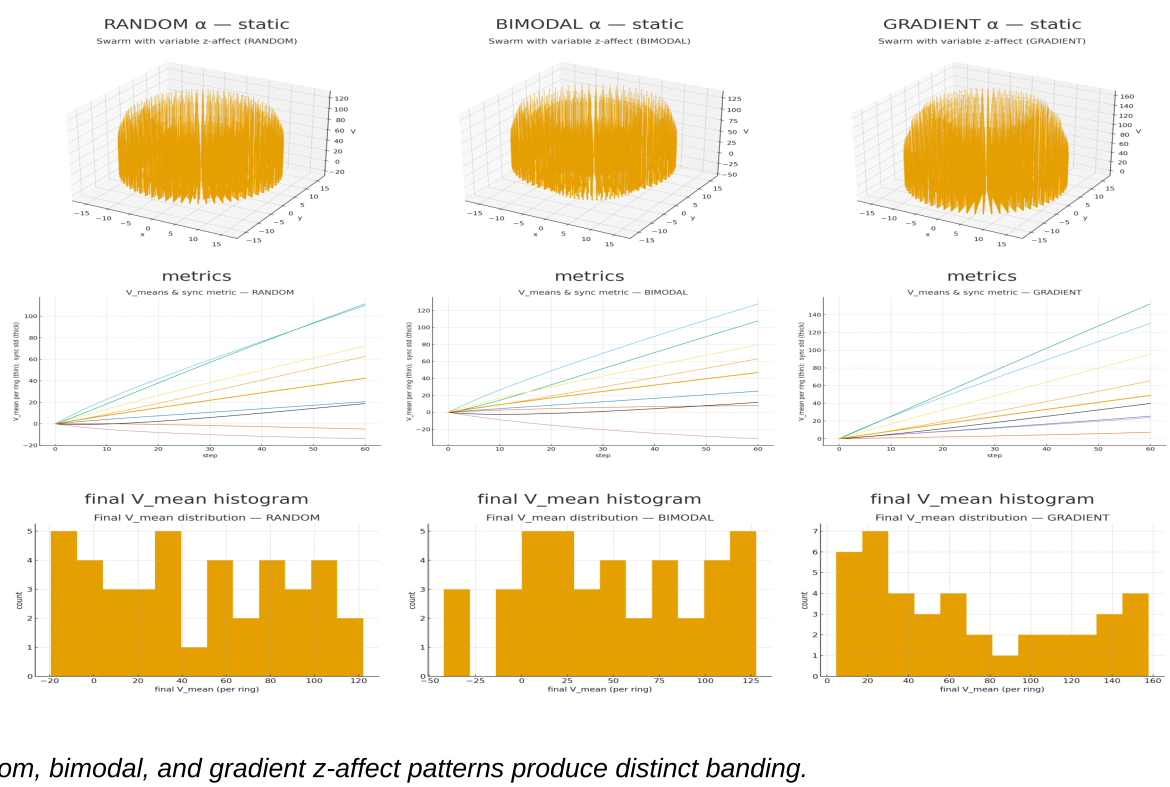
Continuous CUT dynamics (ODE form).

4. From one ring to a swarm

Scale to many rings with ring-specific lambda_j, height z_j, and neighbor coupling gamma. Apply 90-degree rotation each step, then update V with the rule below.

$$\Delta V_j = \lambda_j \sqrt{x_j^2 + y_j^2} + \alpha_j z_j + \gamma\left(\frac{V_{j-1} + V_{j+1}}{2} - V_j\right)$$

Swarm update: lambda-lift, z-affect, neighbor coupling.



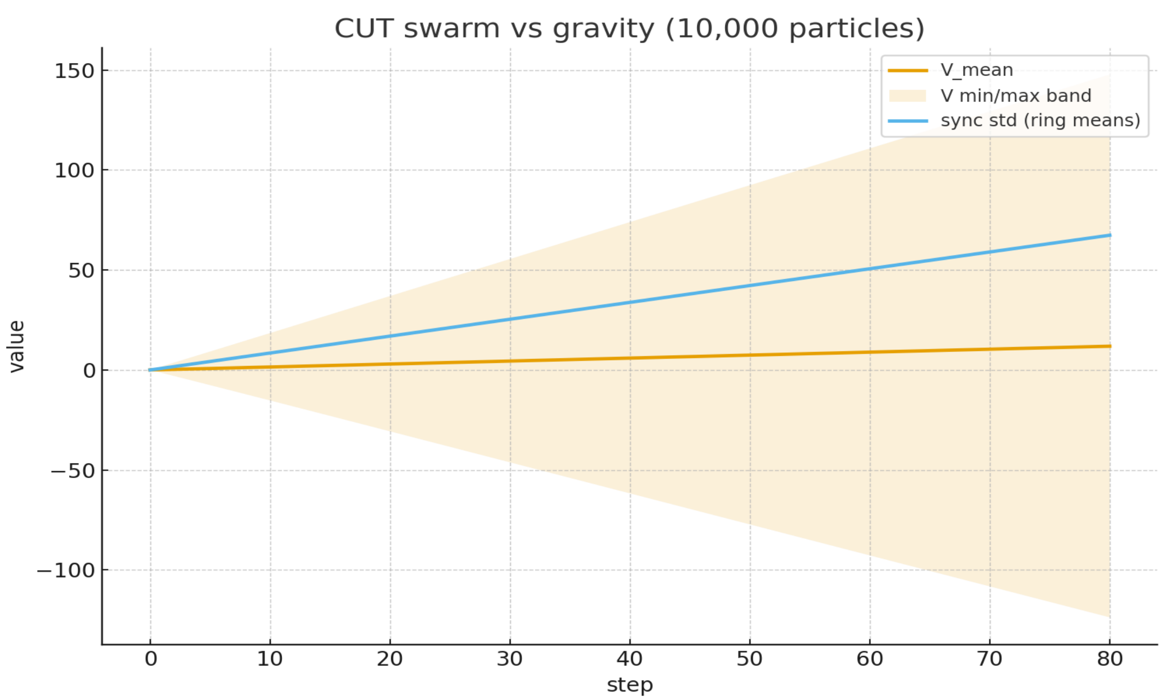
Random, bimodal, and gradient z-affect patterns produce distinct banding.

5. Gravity as i^-1 pressure

Add a global opposing term g. In brittle models this collapses the system. In CUT-i the swarm self-organizes and keeps rising.

$$\Delta V = (\lambda - g)\sqrt{x^2 + y^2} + \alpha z + \gamma(\bar{V}_{nbr} - V)$$

Opposing pressure g competes with lambda-lift.



10k-particle test: mean V rises; spread stays bounded; synchronization stabilizes.

6. How this ties back to the conjecture

Real multipliers in G keep a torus in R^3. Imaginary ones require the V extension. CUT-i yields a quasi-torus helix: topology (genus 1) is preserved while geometry gains helical layering in V.

$$P(\text{Breakoff}) = kV$$

*Optional: breakoff probability knob P(Breakoff)=k*V in the CUT narrative.*

7. What is proved vs. conjectured

Simulations give strong evidence of stability and structure. A formal theorem would require invariants or a proof of class behavior under the CUT-i action.

8. Conclusion

The conjecture forced a geometric meaning for i. Defining CUT-i as rotate-plus-lift ties the hypothesis to concrete behavior: helical banding and resilience under stress. This completes the arc from conjecture to operator to swarm dynamics.