PUT UP OR SHUT UP: A Minimalist Proof-of-Concept for Graphene-Enhanced Hybrid Stochastic Logic Gates

Purpose:
To demonstrate that post-deterministic logic gates using G-FETs and ion chambers can produce reproducible, non-Gaussian stochastic signals suitable for entropy auditing, probabilistic logic, and quantum preprocessing—using only off-the-shelf components, room-temperature operation, and no metaphysical claims.

Phase 1: Core Signal Demonstration

Objective

Show that a G-FET under DC bias produces 1/f noise distinguishable from Johnson noise, and that this signal can be thresholded into logic outputs.

Materials

- **Graphenea GFET-S10 or S20** ($150–$300)
- **NE5532P Op-Amp** ($0.69)
- **Raspberry Pi Pico** ($4.00)
- **Ion Chamber Module** (e.g., smoke detector salvage or $100 commercial)
- **Basic resistors, capacitors, perfboard, shielding** (~$20)

Procedure

1. **Mount G-FET** on perfboard with stable DC bias (1–10 V).
2. **Amplify output** using NE5532P in low-noise configuration.
3. **Mix with ion chamber signal** via summing amplifier.
4. **Threshold with comparator** to produce binary output.
5. **Log signal** using Pico at ≥50 kHz.
6. **Analyze FFT** for 1/f slope and heavy-tailed distribution.
7. **Run Diehard tests** on thresholded output to verify entropy.

Expected Outcome

- Reproducible 1/f noise spectrum from G-FET.
- Distinct from white noise baseline.
- Thresholded output shows probabilistic toggling.
- Entropy metrics exceed pseudorandom generators.

Phase 2: Hybrid Gate Demonstration

Objective

Show that combining G-FET and ion chamber signals yields a post-deterministic gate with tunable entropy and stable output.

Procedure

1. **Repeat Phase 1 setup** with both sources active.
2. **Tune comparator thresholds** to adjust gate sensitivity.
3. **Log output over time** and compare to single-source gates.
4. **Demonstrate reproducibility across multiple G-FETs**.

Expected Outcome

- Hybrid signal shows enhanced entropy.
- Gate output is stable, reproducible, and tunable.
- No need for cryogenics or exotic shielding.

Phase 3: Quantum Core Interface (Optional)

Objective

Show that stochastic gate output can modulate photonic paths or verify quantum states.

Materials

- **Beam splitter, phase shifter, SPD** (optional, ~$10,000)
- **Coupling circuit** from gate output to photonic modulator

Procedure

1. **Use gate output** to trigger photonic path selection.

2. **Demonstrate modulation or verification** of quantum states.
3. **Compare entropy profile** to known quantum sources.

Expected Outcome

- Hybrid gate acts as entropy auditor or preprocessor.
- Photonic core responds to stochastic modulation.
- Demonstrates scalable path to universal quantum computing.

Epistemic Position

- **No extraordinary claims**: All phenomena are grounded in known physics.
- **No metaphysical appeals**: Only empirical reproducibility and structural honesty.
- **No proprietary dependencies**: All components are open-market and replicable.
- **No rhetorical inflation**: This is a demonstrator, not a revolution—until it proves itself.
