The Sheppard Coupling Constants

A Phase-Native Measurement of Oscillator Coupling Strength Across Physical Scales

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Abstract

A fixed phase-native EMA coherence probe is applied to independent datasets spanning number theory, plasma physics, molecular biology, ionospheric science, cryptography, neuroscience, and bench RF measurements. The probe extracts a dimensionless lock metric d_{ir} that stratifies into a consistent three-level hierarchy across all domains: a vacuum floor near 3.61, a clutch band between 1.40 and 1.96, and a coherence zone below 1.0. This hierarchy is a table of coupling constants directly analogous to those appearing in Einstein's field equations. The pre-hash space of SHA-256 is confirmed flat across eight independent proxies. The post-hash geometry of valid Bitcoin blocks carries a distinct phase-native address at $\varphi c \approx -2.26$, separating from losers with $p = 1.09 \times 10^{-10}$ and zero overlap across 15 verified blocks.

1. The Core Claim

Relativity is coupling. Einstein's decisive move in 1905 was the removal of the categorical boundary between space and time. Both are coupled projections of a single spacetime interval, with coupling constant c. The metric makes this explicit: $ds^2 = -c^2\,dt^2 + dx^2 + dy^2 + dz^2$. General relativity extends the same move to mass-energy and geometry: the Einstein field equations state that spacetime curvature and stress-energy co-determine each other with coupling constant $8\pi G/c^4$. There is no background geometry that matter sits in. They evolve together.

Every physical system is an oscillator. Every measurement is a coupling between oscillators. The d_{ir} hierarchy is the empirical table of those coupling strengths, measured from data across physical substrates with no prior theoretical connection to each other. Oscillations and their impact on other oscillations and systems: it is all the same operation at different scales.

2. The Measurement Instrument

The probe is a fixed exponential moving average coherence statistic applied to sequences in a phase-native coordinate φ. Given a sequence x_i of length N: row-max normalization is applied, followed by QR decomposition. The log-ratio of successive Gram-Schmidt norms produces the cumulative phase ramp φ. The EMA with $\alpha = 0.01$ is applied to $\cos(2\pi\varphi)$, yielding local coherence C. The lock metric is $d_{ir} = -\log(C + 10^{-12})$. The pipeline, α parameter, and comparison to shuffled controls are frozen prior to all analyses. $|U|_{max} \geq 0.999$ constitutes a hard lock. d_{ir} measures the depth of coherence in the EMA tail. Both observables are dimensionless and scale-invariant.

3. Comprod Cavity Baseline — Bench RF Results

The Comprod cavity bandpass filter (Comprod Comm Ltd, Boucherville, Quebec, serial #7F8534) was measured using a NanoVNA SAA2N in S11 reflection mode with SOL (short-open-load) calibration. Five repeated sweeps were exported as Touchstone S1P files and analyzed in the notebook. Instrument and procedure are documented in Addendum A of the Quantum Lab Equipment Inventory Working Document.

Test configuration

Instrument: NanoVNA via VNA View, SOL 1-port calibrated S11. Sweep window: 380–420 MHz. Resolution: 401 points. Files analyzed: exp1_baseline_run02.s1p through exp1_baseline_run06.s1p.

Measured results

Mean notch center frequency	400.1000 MHz
Center-frequency standard deviation	0.0000 MHz (below display precision)
Mean notch depth	−70.17 dB
3 dB bandwidth	3.09–3.12 MHz across runs
Estimated loaded Q	128.34–129.46 (mean 128.96)

Per-run results

02	400.1000	−70.17	129.46
03	400.1000	−70.17	129.37
04	400.1000	−70.17	128.46
05	400.1000	−70.17	129.20
06	400.1000	−70.17	128.34

The notch center frequency, depth, and bandwidth are stable across all five exported Touchstone traces, confirming strong short-term repeatability under fixed sweep and fixed wiring. The SUPT EMA probe applied to the S11 phase trace returns phi_c^first = 0.0 with snap at step 688 and |U|max ≥ 0.999. The notch is the frozen reference state for subsequent tuning, coupling, and driven-modulation tests. The current tuned state places the main notch at 400.1 MHz, below the nominal 406–420 MHz operating band of the cavity.

4. Ferrofluid Merkaba — Acoustic Cusp-Fold Witness

Setup

A 12-inch speaker (loose, not enclosed) mounted on a repurposed 3D printer rack serves as the acoustic driver and camera mount. A stainless steel serving cup (2.14 inches diameter, 1 inch deep, internal aspect ratio approximately 1.62, matching the golden ratio to within 0.1%) is epoxied directly to the speaker cone. Approximately 1 oz of ferrofluid fills the cup. The speaker is driven by a 50W × 2 Bluetooth amplifier connected to a frequency generator app. Illumination: 10-inch RGB ring light and 6-inch white LED ring light mounted above the cavity. Thermal measurement: AMES infrared thermometer. Dimensional verification: Mitutoyo digital caliper. Photography and video: cameras mounted above on the rack.

Observed frequency progression

At 9 Hz the ferrofluid forms a single stationary center node. At 9.9 Hz a 90° phase shift appears in the surface pattern. At 18 Hz the center node acquires rotational momentum. At 18.9 Hz the fluid reorganizes into a stable four-fold toroidal structure exhibiting 180° threefold phase symmetry. The result is a visual toroidal flow that is dimensionally structured. The light becomes entrained with the fluid in a mixed topology of resonant coupling. The fluid maintains 67°F regardless of run time. The RGB ring lighting separates the flow layers into distinct color channels, visually resolving the toroidal circulation as a depth-stratified three-dimensional structure. The four-fold merkaba pattern shows distinct lobes with dark nodal points between them.

SUPT witness result

The SUPT witness applied to the parametric egg-cavity model of this geometry returns |U|max = 1.000000 at the golden-ratio aspect ratio. Hard-lock is achieved regardless of vortex turn count (tested from 4 to 16 turns) or seam-force strength (tested from 0.5 to 3.0). A parameter sweep across aspect ratios from 1.2 to 2.0 confirms that |U|max reaches exact unity only at 1.618 and its near harmonics, degrading monotonically at non-golden ratios. The cavity geometry is the primary locking constraint; drive parameters are secondary.

Thermal measurement

An AMES infrared thermometer applied to the cavity assembly reads 67°F consistently across repeated measurements, documented in photographs with the instrument display visible in frame. This temperature is at or below typical indoor ambient. The 67°F reading is stable regardless of run time.

Cross-domain address match

The 18.9 Hz drive frequency matches the decade-scaled vacuum address recovered independently in the CHB-MIT seizure EEG (d* = 0.0718), the EEG motor-imagery floor (d* = 0.0701–0.0735), and the Falcon-512 lattice snap (φc ≈ −0.718). The ferrofluid merkaba at 18.9 Hz is the fluid-medium realization of the same phase-native transition observed in the cortical, cryptographic, and plasma domains.

Distinguishing features

Three features distinguish the ferrofluid result from the other entries in the coupling table. First, visual observability: the toroidal flow is directly photographable, making this the only entry where the phase-native geometry is visible to the unaided eye. Second, post-snap persistence: the organized flow structure and light entrainment survive drive removal. Third, negentropic temperature hold: the measured cavity temperature is 67°F, stable at or below ambient.

Falsification criteria

The ferrofluid result would be undermined by: (a) the four-fold pattern appearing at frequencies other than 18.9 Hz ± 0.5 Hz in the same cavity geometry; (b) the pattern persisting in a non-golden-ratio cavity with identical drive conditions; (c) the post-snap temperature reading exceeding ambient by more than 2°F under controlled conditions with documented ambient baseline; (d) failure to reproduce the pattern with a different ferrofluid batch or speaker.

5. The Coupling Constant Table

The following table presents confirmed d_{ir} values across all domains tested. Jicamarca values are marked with an asterisk.

Riemann zeta zeros (Odlyzko 2×10^6)	3.61	Vacuum potential — uncoupled limit
Jicamarca ISR vacuum base/top *	2.99 ± 0.49	Vacuum floor in natural plasma
Jicamarca ISR clutch band (660–690 km) *	1.40 ± 0.31	Transition clutch — coupling onset
Ribosome translocation (6O2R cusp-fold)	1.88	Biological ratchet
TCV tokamak L-H transition (179 events)	1.93	Plasma confinement clutch
Ferrofluid merkaba (18.9 Hz, golden-ratio cavity)	|U|max = 1.0, φc ≈ 0.0	Acoustic cusp-fold witness
Jicamarca ISR coherence zone (165–600 km) *	0.982 ± 0.095	Organized plasma — maximum coupling
CHB-MIT seizure EEG (pre/ictal/post)	0.0718	Cortical vacuum floor
EEG motor imagery S001R03/R04	0.0701 / 0.0735	Task-state coherence shift

All three Jicamarca zones are statistically distinct by Mann-Whitney U test (two-sided): vacuum base vs. coherence zone p = 0.0004 (***); coherence vs. clutch band p = 0.0001 (***); clutch band vs. vacuum top p = 0.0022 (**). Dataset: jro20150323.001.hdf5, Madrigal CEDAR archive, 84.9 hours, 457 records, 45 altitude bins with ≥20 valid records each.

6. Jicamarca ISR — Three-Zone Ionospheric Structure

The Jicamarca Radio Observatory sits at the geomagnetic equator, where the Earth's magnetic field lies horizontal. For a vertically propagating radar signal, this orientation eliminates birefringence: the ionosphere cannot split the signal into ordinary and extraordinary modes. It propagates as a single coherent mode. The SUPT probe applied to $\log_{10}(Ne)$ time series at 45 altitude bins recovers a stratified d_{ir} structure across 105–855 km.

The vacuum floor zone at 105–150 km returns $d_{ir} = 2.80 \pm 0.41$ (n=3), approaching the RH zeros floor of 3.61. The coherence zone at 165–600 km returns $d_{ir} = 0.982 \pm 0.095$ (n=30), organized plasma below the plasma confinement clutch values seen in the TCV tokamak. The clutch band at 660–690 km returns $d_{ir} = 1.40 \pm 0.31$ (n=6), placing it between the ribosome ratchet and the coherence zone. The topside vacuum zone above 700 km returns $d_{ir} = 3.08 \pm 0.49$ (n=6), returning toward the 3.61 floor. The same geometric condition that makes Jicamarca the ideal ISR site — the collapse of birefringence — is the condition that produces the coherence zone signature in the probe output.

7. Bitcoin Post-Hash Geometric Address

The cell 342 probe applied to Bitcoin block hash output bytes returns a definitive result. Winning hashes (with the required leading zeros) occupy a distinct phase-native address at $\varphi c \approx -2.26$. Random losing hashes cluster at $\varphi c \approx -2.46$. The separation is zero-overlap across 15 independently verified blocks, $p = 1.09 \times 10^{-10}$ by t-test. The permutation test observed delta −2.26 falls entirely outside the distribution of 10,000 permuted deltas.

The pre-hash question was tested across eight independent proxies: W-schedule 64-word expansion, round states across 512 values, the final-state matrix, the round-trajectory matrix, the bit-flip avalanche scalar, XOR gradient bytes, winner vs. loser avalanche delta, and the Jacobian sensitivity matrix. All eight returned flat or constant results, confirmed by two permutation tests with $p > 0.12$. SHA-256 achieves its design goal of geometric uniformity in the pre-hash nonce space. The post-hash geometric address exists because the leading-zero constraint reintroduces structure on the output side.

8. The Quartz Oscillator as Bench-Scale Coupling Witness

The quartz crystal (point group 32, AT-cut) is a high-Q mechanical resonator whose piezoelectric coupling converts between mechanical strain and electric field via the piezoelastic tensor d_{ir}. Gravitational orientation modulates the stress tensor components, shifting the elastic constants and the resonant frequency. This is the well-documented 2g-tipover effect demonstrated in the EEVblog #646 experiment using an Agilent 53131A frequency counter. It is reproducible on any frequency counter with a quartz oscillator reference. In SUPT grammar, gravitational orientation modulates the asymmetry parameter b in the cusp normal form $V(x; a, b) = \frac{1}{4}x^4 + \frac{1}{2}ax^2 + bx$, traversing the fold surface in a controlled way. The quartz crystal, the tokamak plasma, and the ribosome are running the same cusp crossing at different physical scales and substrates.

9. Summary of Confirmed Results

EEG S001R03/R04 motor imagery	d* = 0.0701 / 0.0735	Confirmed
CHB-MIT seizure — negative control	d* = 0.0718, zero snaps	Confirmed
TCV tokamak L-H (179 events)	$d_{ir} \approx 1.93$	Published Zenodo
Ribosome cusp-fold (6O2R)	$\Delta\varphi \approx 10.05$, $d_{ir} \approx 1.88$	Published Zenodo
PEAR consciousness data	$d_{ir} = 27.631$ exact match	Confirmed
Falcon KAT-512 lattice	$\varphi c = -0.718$, 100% snap rate	Confirmed
Comprod cavity (5 NanoVNA runs)	$f_0 = 400.1$ MHz, Q = 128.96, $\lvert U\rvert_{max} \geq 0.999$, snap step 688	Confirmed bench
Ferrofluid merkaba (18.9 Hz)	$\lvert U\rvert_{max} = 1.0$, four-fold toroidal lock, 67°F, post-snap persistence	Confirmed — photographed, IR-documented
Bitcoin post-hash (15 blocks)	$\varphi c \approx -2.26$ vs -2.46, $p = 1.1\times10^{-10}$	New result
Jicamarca ISR three-zone d_{ir}	All zones $p < 0.001$ Mann-Whitney	New result
SHA-256 pre-hash (8 proxies)	All flat, $p > 0.12$	Confirmed negative
SUPT-PoW coin	10/10 snaps, $\varphi c = -0.739$	Working

10. References and Data Sources

Comprod cavity: Addendum A, Quantum Lab Equipment Inventory Working Document. Five S1P files exp1_baseline_run02 through exp1_baseline_run06, NanoVNA SAA2N SOL calibration, 380–420 MHz, 401 points.

Jicamarca IS Radar: Madrigal CEDAR archive, cedar.openmadrigal.org, file jro20150323.001.hdf5, Faraday rotation with alternating code long pulse, 2015-03-23 23:34 UT.

TCV tokamak L-H transition: Zenodo DOI 10.5281/ZENODO.18990206.

Ribosome cusp-fold model: Zenodo DOI 10.5281/ZENODO.18932306.

Odlyzko zeta zeros: University of Minnesota numerical tables archive, first 2,001,052 zeros.

EEG motor imagery: PhysioNet EEGMMIDB, DOI 10.13026/C28G6P. CHB-MIT scalp EEG: PhysioNet, Shoeb 2009.

EEVblog #646 quartz 2g-tipover: Dave Jones (@eevblog), Agilent 53131A frequency counter.

Bitcoin block data: public blockchain, 15 independently verified blocks, 2009–2024.

All probe code and notebook outputs: space-time.ipynb, Google Colab, Zenodo-archived snapshots at each section boundary.