Orbital Nernst transport in YIG/Pt/CuO_x read through FDT: a clock-factor gradient, an antisymmetric projection, and predictions from a twist, an oxygen isotope and an inverse conversion

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Target: W.-Y. Li, C.-C. Chang, S.-Y. Huang and D. Qu (SC-004, L8–L9, title block), "Transport evidence for the orbital Nernst effect" (SC-002, L5–L6, title block), Nature Communications (2026) 17:11032 (SC-006, L64, footer), doi:10.1038/s41467-026-77878-2 (SC-001, L2, title block); received 14 April 2026 (SC-003, L8, title block), accepted 7 September 2026 (SC-005, L12, title block); no arXiv identifier is printed.

Abstract

Li, Chang, Huang and Qu "report the first experimental evidence for the orbital Nernst effect by measuring the magneto-thermopower in the yttrium iron garnet (YIG)/Pt/CuOx heterostructures" (SC-010, SC-011, L23–L25, abstract) [1]. This analysis reads the source through Fundamental Density Theory (FDT), a true extension of general relativity and quantum mechanics that agrees with their data without reservation; on the source's own inputs FDT returns every ratio, estimate, angle and conductivity it prints for its samples with 3 nm of Pt, each step the identity map, and no input of its ratios at 5 nm of Pt is printed. In this analysis's reading the thermal drive is a gradient of the conduction electrons' clock factor (0.1c, I-7), the transverse orbital and spin currents are flows of the bivector grade (I-3a, P-5), the applied field is a helical density gradient (P-5), and a conversion and its inverse are two system-wide settlements (0.1a). Where a core clause supplies what the consensus calculation lacks, the analysis states five predictions, three of existence and two of sign, each decided by an exact sign-flip rule: a hand-odd, reciprocity-odd resistance of a Pt-coated element twisted in zero applied field, on YIG and on a non-magnetic garnet (P-5); shifts of the logarithms of the Pt layer's two effective ratios when the Cu is oxidized in ^{18}O rather than in ^{16}O, upward in this analysis's reading of I-7's density-channel input sign (I-7); and a difference between the factors by which the CuO_x multiplies a conversion and its inverse (0.1a).

1 Framework

Source, status and verbs. The source is the article of Li, Chang, Huang and Qu [1]; source_status: experimental. Its results are measured, observed or reported; everything else here is derived, estimated, reconstructed or illustrative-assumed. A citation names the claims-ledger row that carries the quoted line (SC-nnn, or SL-nn for a sign or glyph of the typesetting), the line (Ln) and its column; SA-nn names a point at which the source's data under-determine its reading, and U-nn an input the source does not print. Every attribution keeps the cited line's nouns, verbs and modal; a sentence that states what this analysis reads of the source opens with "In this analysis's reading", a table cell with "Reading:", and none is attributed to the source.

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Notation guard. The source's symbols that collide with the core's tokens are renamed on every surface, prose, displays, tables and captions, and one symbol carries one meaning throughout; the census is the table below. The isotopes are written ^{18}O and ^{16}O. The source's acronyms stay roman with its expansions: SOC, "spin-orbit coupling" (SC-017, L37–L38, left); ONE and ORNE, "the orbital Nernst effect" and "the orbital Rashba-Edelstein Nernst effect" (SC-020, SC-021, L47–L48, left), the source's ONE including the ORNE from L104 on: the orbital angular momentum "generated from the ORNE is also implicitly included in the discussion" of ONE (SC-053, L104, left; SA-15); SNMT and ONMT, the "spin and orbital Nernst magneto-thermopower" (SC-072, L131–L132, right); SMR, "spin Hall magnetoresistance" (SC-146, L191, right); MR, magnetoresistance.

source token (row; loci)	source meaning	name here; core meaning kept
α (SY-01; L168, L274, L345)	spin and orbital Nernst conductivities	$\mathcal{N}_{\mathrm{SN}}$, $\mathcal{N}_{\mathrm{ON}}$; a bare α is the curvature ratio
σ (SY-02; L87, L107, L293, L321, L345)	the spin; the Hall conductivities	"the spin" in words; $\mathcal{C}_{\mathrm{SH}}$, $\mathcal{C}_{\mathrm{OH}}$; σ is the branch tag
θ (SY-03; L165, L166, L238, L272, L315, L345)	spin Hall, spin Nernst, orbital Hall, orbital Nernst angles	Θ_{SH}, Θ_{SN}, Θ_{OH}, Θ_{ON}; θ is a Snell angle
S (SY-04; L146, L162, L188, L199, L345)	Seebeck coefficients	$\mathcal{S}$ with roman subscripts, $\Delta\mathcal{S}$; S_i are I-7's sensitivities
R (SY-05; L194, L196, L199, L219, L254)	resistances, the sheet resistance among them	$\mathcal{R}$, a roman subscript naming which, $\Delta\mathcal{R}$; R is a core radius
ρ (SY-06; L164, L224, L270)	resistivities	$\mathfrak{r}_{\mathrm{Pt}}$, $\mathfrak{r}_{\mathrm{CuOx}}$; ρ is a radius or a density
λ (SY-07; L160, L222, L233, L266, L307)	Pt spin diffusion length	$\mathfrak{l}_{\mathrm{sd}}$; λ_i is I-4's token
G (SY-08; L161, L223, L267, L307)	spin-mixing conductance	$\mathfrak{g}_{\mathrm{r}}$; G is Newton's constant
t (SY-09; L224, L374)	Pt thickness	$\mathfrak{d}_{\mathrm{Pt}}$, and $\mathfrak{d}_{\mathrm{CuOx}}$; t is time
T (SY-10; L100, L154, L162, L176)	temperature	T, the temperature of I-7 and 0.1c
H (SY-11; L148, L158, L159, L221)	applied magnetic field	H; H is I-5's helicity
M, m (SY-12; L87, L107, L161, L239, L293)	YIG magnetization; m, undefined, in Eq. (2) and Eq. (4)	"the magnetization" in words; M is the rest mass, m a mass, m held moments
J, I (SY-13; L84, L89, L100, L335)	charge and spin currents	"the charge current", "the spin current"; J is an angular momentum
V (SY-14; L156, L158, L162)	Seebeck voltage	$\mathcal{V}$, $\mathcal{V}_{\mathrm{as}}$; V is a volume
x, y (SY-15; L156, L159, L204)	axes and subscripts	upright x, y; x_i are I-7's coordinates
X (SY-16; L388, L389)	a placeholder film	"the film or stack"; X is the odds
Ω (SY-17; L194, L196, L219, L242, L254, L274)	the unit ohm	the upright unit Ω; Ω is the confinement domain
a–f (SY-18; L86, L93, L174, L178)	panel letters	"panel a"; a is the radiation constant
none (SY-19)	this analysis's own symbols	$\mathfrak{L}$, $\mathfrak{D}_{\mathrm{Pt}}$, $\mathfrak{z}$, and $\mathfrak{q}$, $\mathfrak{y}$, $\mathfrak{b}$, $\mathfrak{c}$, $\mathfrak{h}$, $\mathfrak{E}$, $\mathfrak{u}$, $\mathfrak{v}$, $\mathfrak{p}$ with roman subscripts; $\mathcal{P}$; the twist $\mathfrak{w}$; B a field in tesla; $\mathfrak{n}$ an index; the core's fraktur letters are never reused

Domain of the medium readings. With $\mathcal{U}$ a pattern's four-velocity in the time it keeps on its own clock, $\nabla_{\mathcal{U}}$ the covariant rate of change along its path, $g_{\mu\nu}$ the metric, $T_{\mu\nu}$ the stress tensor, T the temperature, c the strand rate and $\mathfrak{P}^{\mu\nu} = c^2 g^{\mu\nu} + \mathcal{U}^\mu \mathcal{U}^\nu$ the projector across the path, the core's paragraph on the medium's clock factor reads in full: "For a medium of energy density E/V and pressure P at zero net conserved count, the conservation $\nabla_\mu T^{\mu\nu} = 0$ projected across the path and the Gibbs–Duhem relation give

$$\begin{aligned} (E/V + P)\, \nabla_{\mathcal{U}} \mathcal{U}^\mu = -\mathfrak{P}^{\mu\nu} \partial_\nu P, \qquad dP = (E/V + P)\, \frac{dT}{T}, \\ \Longrightarrow \quad \nabla_{\mathcal{U}} \mathcal{U}^\mu = -\mathfrak{P}^{\mu\nu} \partial_\nu \ln T \qquad \text{every equation of state } P(T). \end{aligned} \tag{1}$$

The medium's patterns are free of every force in $T^2 g_{\mu\nu}$: the temperature of I-7 is their clock factor, the entries E and PV per volume their inertia, and the pressure force the bookkeeper's reading of their common rescaling. With a conserved count N and fixed entropy per count the clock factor is the enthalpy per count, $(E + PV)/N$. The medium's clock factor is the reading of its flow: it rescales the metric in which the flow is free, never the time kept by a clock the medium carries — that clock runs on the lapse where it sits, and its thermal shift is the time dilation of its own thermal motion" (0.1c). The paragraph holds for a stress tensor of perfect form, and the domain of every medium reading below is declared here, once: the conduction electrons of the source's Pt and CuO_x films form a medium with a conserved count N, and on the clause's two premises — a stress tensor of perfect form and fixed entropy per count — that medium's clock factor is its enthalpy per count. No number is taken from the clause.

The two readings, stated as the framework's own (0.1c, I-3a). A pattern's kept time t and thread length d rescale together by a positive dimensionless clock factor $\mathfrak{m}$, $d/t = c$ kept on the spot; for the metric the rescaling is $g_{\mu\nu} \mapsto \mathfrak{m}^2 g_{\mu\nu}$, and the distant bookkeeper reads the free pattern with the acceleration

$$\nabla_{\mathcal{U}} \mathcal{U}^\mu = -\mathfrak{P}^{\mu\nu} \partial_\nu \ln \mathfrak{m}, \tag{2}$$

toward smaller $\mathfrak{m}$, where the pattern's clocks run slower, while on the pattern's own clocks and rulers nothing changes. Moving at constant speed, on the pattern's own clocks and rulers, through a density gradient is gravity: the extended equivalence principle (0.1c). A slow pattern reads the clock factor, the lapse, and a stroke reads the optical metric of I-3; the factor of two of I-3 is that principle read on a stroke. The bookkeeper's reading is a flow: with G Newton's constant, $\mathcal{M}$ a body's total gravitating energy, r_f a field-point radius and α_{ext} that body's exterior compactness there (I-3), in the static exterior, patterns falling from rest far away move inward at $v = c\sqrt{\alpha_{\text{ext}}}$ and fall at exactly $G\mathcal{M}/r_f^2$, and the flow runs at every size. At this first use of an α token the chart inventory is declared, once (I-3 chart discipline 1): every α token is branch-tagged, σ the branch tag; the atlas α_σ of the compactness application (A-1), warranted by two geometrically fixed lengths, has α_{ext} and α_{int} for its exterior and interior branches, field-point evaluations, I-1's per-body inputs among them, configuration evaluations at a support radius and gravitating-source evaluations, and a nucleus, P-3's clamp, is carried by two charts, the exterior atlas of the nucleus as a gravitating source, its fold at the nucleus's own Schwarzschild radius, and the interior chart of the nucleus as a configuration, read with its skin at the fold and its skin radius taken from data (U-21), with no transfer map between them; the computational β_σ of the compactification application (A-2), the bounded map applied to α_σ as an odds, never stands in a force, optical or density slot; α_{ovl} (O-2), α_{conf} (O-3) and α_{mode}, of the overlap-contrast (A-3), confinement (A-4) and mode-manifestation (A-5) applications, have no geometric warrant and are each a range with no value, threshold, ordering, sign or trajectory; and the saturation diagnostic α_{core} of a nucleus's

interior chart, tending to the upper end of the open interval every α lives on (0.4), is schematic only; the table of the I-3 paragraph below sets out each token with its warrant and evaluations. A curvature, a tide or a density gradient is read between neighbours — two patterns, or a pattern and a reference path, an extended pattern's skin against its own centre path among them — never off one pattern alone (I-3a; Use item 7). A medium's clock factor is never the rate of a clock the medium carries, never stands in an α, odds, force, optical or density slot, and never bends a stroke; a laboratory pattern's gravitational window is small, and the small number is a correct reading (0.1c, I-1). The helical window belongs to a closed pattern whose rest energy depends on where it sits in a twist, here the YIG's: with m its held moments, B the twist's magnetic field where they sit, E_{ind} the energy of the moments the twist induces in it, the work of inducing them included, E_0 its rest energy outside every twist and $\mathcal{M}$ its total gravitating energy (0.1c, 0.5),

$$E = E_0 + E_{\mathrm{ind}} - \sum \mathsf{m} \cdot \mathsf{B}, \qquad \mathcal{M} = E/c^2, \qquad \mathfrak{m} = E/E_0. \tag{3}$$

There $\mathfrak{m}$ belongs to the pattern, the universality of free fall is the gravitational window's and stands, and "a uniform twist, a uniform level of $\mathfrak{m}$, turns a held moment and pushes nothing" (0.1c). No $\mathfrak{m} = E/E_0$ is written here for a current or a stroke, and no frequency is read off a temperature.

The chain and its bridges. FDT has one substance, the omnium; with E an energy, m a mass and ε_0 and μ_0 the omnium's two responses (0.1d), its chain $E/m = c^2 = 1/(\varepsilon_0\mu_0) = (d/t)^2$ is one identity read by quantum mechanics, electromagnetism and general relativity, its four terms adjusting together, settled by one global optimisation (0.1, 0.1a). With m_q the mass of a mode q of a closed pattern, E_q its energy, ω_q its angular frequency, $\hbar$ the reduced Planck constant, $h = 2\pi\hbar$, $\mathcal{T}_q$ the time the pattern keeps (so written because T is the temperature) and ℓ_q the length its thread runs in that time, the bridges are constants of the medium:

$$E_q = m_q c^2 = \hbar\omega_q, \qquad \mathcal{T}_q = \frac{2\pi}{\omega_q} = \frac{h}{E_q}, \qquad \ell_q = c\,\mathcal{T}_q = \frac{h}{m_q c}, \qquad \frac{d}{t} = c, \tag{4}$$

with $c = 299\,792\,458\ \mathrm{m\,s^{-1}}$ exactly, metres locked to seconds (0.1a), and ℓ_q the Compton length, never the support R_{box} (I-5). With E quantised and c constant the discreteness lands in the rest masses of confined patterns, confinement eigenvalues of an operator of which no form is written here (O-9), and in the null periods and paths at the locked ratio $\ell_q/\mathcal{T}_q = c$, bounded below by $2\ell_{\mathrm{P}}$ and $2t_{\mathrm{P}}$, with ℓ_{P} and t_{P} the Planck length and time, a one-sided infimum and no lattice (0.1a). The strand rate c is derived, not given (0.1d): the two responses give $c^2 = 1/(\varepsilon_0\mu_0)$, c turns the time reading of the omnium into its space reading and, squared, its matter reading into its energy reading, and a closed pattern's strand runs at c on a helix, its speeds along and around the helix adding in quadrature to c, its inertia E/c^2 carrying the stress of its closure.

1.1 The seven invariants, each where it is used

I-1 and I-6: the force law, driven observables, response coefficients. With F the force between two bodies, G Newton's constant, $F_{\max}$ the force ceiling and α_1, α_2 the two bodies' density coordinates, I-1 holds always, at every scale:

$$F = \frac{c^4}{4G}\,\alpha_1\alpha_2, \qquad 0 < \alpha_i < 1 \implies F < F_{\max} = \frac{c^4}{4G}. \tag{5}$$

On its declared domain — per-body exterior cross-centre inputs $\alpha_i(d) = R_{s,i}/d$, with $R_{s,i}$ the Schwarzschild radius of body i's total gravitating energy $\mathcal{M}_i$, at separation d, on two nonoverlapping

spherical supports of radii $R_{b,i} \geq R_{s,i}$ with $d \geq R_{b,1} + R_{b,2}$, at monopole order — the law reduces exactly to $F = G\mathcal{M}_1\mathcal{M}_2/d^2$. The interval ladder is never conflated: $0 < \alpha < 1$ is universal, a property of the bounded map; $F < F_{\max}$ holds wherever the inputs occupy that interval; and $F \leq F_{\max}/4$ is the only pair-domain statement, its equality needing equal $R_{s,i}$, saturated supports and contact. The source's slab and films are not spherical, and no multipole remainder of the closed-form pair expression is written here (O-5); the maps that turn the films' charges and the YIG's circulating charges into I-1 inputs enter no number here (O-6). "At condensed-matter compactness the bare law returns a small number ($\sim 10^{-41}$ N): a correct prediction, not a wrong-tool symptom — and not the measured binding scale, which is reached only through a declared response kernel (rate $\neq$ force)" (I-1; U-28). The source's voltages are driven observables, zero at zero drive: "A driven observable (induced magnetisation, rectified signal, rate) vanishes at zero drive and never 'recovers' the static force. The force lives in the isolated static functional; measured dynamics are a separate causal convolution $A(t) = \int \chi_A(t - t')\, F_{12}(t')\, dt'$, and the susceptibility maps force $\rightarrow$ observable — it is not the force law" (I-1). Its conductivities are signed dimensionful response coefficients and its angles quotients of two such: "A signed dimensionful response coefficient is not a density — never bounded-in-(0,1), never run through a density map" (I-6); no α, odds or bounded map is built here from an angle, a ratio or a conductivity, and every α lives on the open interval with $\alpha \rightarrow 0^+$ and $\alpha \rightarrow 1^-$ its only, one-sided limits.

I-2: one carrier. The core's identity reads

photon = graviton = gluon = phonon = magnon = the same spin-1 excitation of the density field, at different density / geometry regimes,

and "The gluon is the stroke standing inside a closed pattern's own region (the I-5 mode, $m_q c^2 = \hbar\omega_q$); the magnon is the stroke through a helical density gradient (P-5). The identity is not a postulate added to the chain; it is the chain read as carriers" (I-2). In this analysis's reading, the strokes of the source's heat current, which "can flow both in-plane and out-of-plane within" "the whole sample" (SC-077, L143–L144, left; SA-26), are the one carrier's, named phonons in the films and the slab and magnons through the YIG's helical density gradient, and the films' conduction electrons, closed patterns, stand outside the identity. "SOC-mediated" is the source's adjective for a conversion (SC-034, L97, left; SA-13) and for an orbital current (SC-134, L264–L265, left; SC-185, L305–L306, left; SA-46, SA-60); in FDT's voice no carrier is exchanged.

I-3: three faces, containment and the chart inventory. With $G_{\mu\nu}$ the Einstein tensor, κ the Einstein coupling, R_s the Schwarzschild radius of a body's total gravitating energy $\mathcal{M}$, r_f a field-point radius, which on the exterior branch runs to ∞, σ the branch tag, α_{ext} and α_{int} the atlas's exterior and interior branches, r_c the finite-core cutoff, or the radius at which a regular core chart takes over, a positive radius of which no value is written here (O-1), X_σ the gap odds, ℓ_{opt} the optical length and Ω the solid angle of the element $d\Omega^2$, the field equation stands unchanged,

α is downstream of its solution, and the three faces are (I-3, 0.2, 0.3)

$$
\begin{aligned}
&G_{\mu\nu} = \kappa\, T_{\mu\nu}, \qquad \kappa = \frac{8\pi G}{c^4}, \qquad \kappa\, F_{\max} = 2\pi, \qquad R_s = \frac{2G\mathcal{M}}{c^2} = \frac{\mathcal{M}c^2}{2F_{\max}},\\
&\alpha_\sigma = \Big(\frac{R_s}{r_f}\Big)^{\sigma}: \quad \alpha_{\text{ext}} = \frac{R_s}{r_f} \;\; (R_s < r_f < \infty), \qquad \alpha_{\text{int}} = \frac{r_f}{R_s} \;\; (r_c \le r_f < R_s),\\
&X_{\text{ext}} = \frac{R_s}{r_f - R_s}, \qquad X_{\text{int}} = \frac{r_f}{R_s - r_f}, \qquad \alpha_\sigma = \frac{X_\sigma}{1 + X_\sigma},\\
&d\ell^2_{\text{opt}} = \frac{dr_f^2}{(1-\alpha_{\text{ext}})^2} + \frac{r_f^2\, d\Omega^2}{1-\alpha_{\text{ext}}},
\end{aligned}
\tag{6}
$$

with $\sigma = +1$ on the exterior and $\sigma = -1$ on the interior branch, carried at every use. Each α_σ is a ratio of two curvatures "built from two lengths fixed before any observation is consulted" (0.3). The exact index of the optical metric serves generalised Snell's law; the aperture index $\mathfrak{n}_{\text{cone}} = (1-\alpha_\sigma)^{-1/2}$ of P-4 is no lensing index, and its constitutive derivation enters no number here (O-8). "Given the same stress tensor, cosmological terms, initial and boundary data and gauge, FDT and GR solve the same equation and return the same curvature" (I-3), and α alone never produces a divergence. The chart inventory declared at the first use of an α token, in the flow sentence of the two readings above, is tabulated here (I-3 chart discipline 1): every α token, its application among A-1 to A-5, its warrant and its evaluations are in the table below.

P-3, the oxygen nuclei and the observation-region rule. A nucleus is one pattern (0.1b), and as P-3's clamp a bound configuration carried by the two charts of the chart inventory, both declared above and tabulated below: "the site's saturation coordinate is not the exterior compactness of the same nucleus ($\ll 1$ for a laboratory nucleus); declare both charts whenever both appear" (P-3). The torsion clamp of T-1 and T-2 is apparatus and is always written "torsion clamp". The local profile is densest at the skin on both branches and the centre is the dilute region (0.6); no form of the local profile is written here (O-4). "Every consensus datum about an interior is a profile-weighted mean $\langle f\rangle_w = \int w f\, dV \big/ \int w\, dV$ with the probe weight named — an rms radius is a skin-weighted second moment, a trace share or a mean pressure a volume mean — so a point value is never read off a mean and no single 'nuclear α' is defined by any of them" (I-3). In this analysis's reading, each datum of the source about a film is such a mean over the film's thickness with its weight named — for a stack's sheet resistance and Seebeck coefficient the conductance weight of the source's own parallel-resistance model (SC-110, L191, left; SC-169, L247, right; SA-38, SA-56), for the two contrasts the region of the Pt within the source's spin diffusion length of the YIG/Pt interface (SC-129, L233, left) — and no point value is read off one (SA-40).

token	application; warrant	evaluation here
α_σ, α_{ext}, α_{int}	A-1 compactness; two geometrically fixed lengths	the atlas, branch-tagged; field-point evaluation $\alpha_i(d)$ for I-1's inputs; configuration evaluation at R_b; gravitating-source evaluation $\mathcal{M}c^2/(2F_{\max}r_f)$, for the slab $\approx 8\times10^{-30}$ at the r_f of U-23, for a film a symbol only
α_{ext}, α_{core} of a nucleus	A-1; P-3's clamp, two charts	the exterior atlas, its fold at the nucleus's own R_s, $\alpha_{\text{ext}} \ll 1$; the interior chart, its skin at the fold and its skin radius R_{room} from data (U-21); $\alpha_{\text{core}} \to 1^-$, schematic only; no transfer map
$\beta_\sigma = \alpha_\sigma/(1+\alpha_\sigma)$	A-2; geometric	computational chart only, never a force, optical or density slot
α_{ovl}	A-3; none	Token, range $(0,1)$ and nothing else: no value, threshold, ordering, sign or trajectory (O-2)
α_{conf}	A-4; none	Token of I-5's position axis, no value (O-3)
α_{mode}	A-5; none	Naming token of I-2, no value; it ranks and spaces nothing

I-4: the quantum face. With m_1, m_2 two masses at separation d and $\lambda_i \equiv \mathcal{M}_i/d$ the three-body token, each form of $F = Gm_1m_2/d^2 = G\lambda_1\lambda_2 = F_{\max}\alpha_1\alpha_2 = (2\pi/\kappa)\alpha_1\alpha_2$ is one statement read in a different limit, and three layers stay separate: the FDT pair algebra, exact in model on its declared domain; containment, general relativity reducing to $G\mathcal{M}_1\mathcal{M}_2/d^2$ in the weak-field slow-motion limit at leading order; and the FDT source programme with each claimed divergence, which the status ledger carries (I-4). The quantum face is quoted whole: "QM is helical geodesics on truncated density cones. The wavefunction $\psi = A\,e^{i\varphi}$ is the projection of a helix onto the plane normal to the cone axis; 'superposition' is ignorance of the helical phase φ_0 at observation. The universe is deterministic; there are no probability amplitudes." (I-4)

I-5: braids and the confinement eigenproblem. "Matter is braided photon helices: closed topological loops formed from n open helical strands of the spin-1 excitation of I-2", and "There are no intrinsic particle masses or properties: charge, colour, flavour, generation and mass are all derived — n sets the topological invariants, confinement sets the mass" (I-5). With D the confinement operator, Ω the domain a pattern is confined to, B its boundary data, χ its orientation, t its position on the inside/outside chart (the core's letter in this display alone) and u_q its mode q, mass is a confinement eigenvalue,

$$D(\Omega, B; n, \chi, t)\, u_q = \omega_q\, u_q, \qquad m_q c^2 = \hbar\omega_q, \tag{7}$$

and no form of the operator D, its domains, boundary data or spectrum is written here (O-9); the two held-out mass ratios are tests a derived operator must reproduce, carried in the status ledger.

I-7: density equivalence. With M a body's rest mass, E, P, V and T its energy, pressure, volume and temperature, a the radiation energy-density constant and σ_{SB} the flux constant,

$$\mathcal{M} = M + \frac{E}{c^2} + \frac{PV}{c^2} + \frac{aT^4V}{c^2} + \ldots, \qquad a = \frac{4\sigma_{\text{SB}}}{c}, \qquad R_s = \frac{2G}{c^2}\,\mathcal{M}, \tag{8}$$

mass, energy, temperature and pressure entering one R_s, every channel once (I-7, 0.5), with $a = 7.566\times10^{-16}\ \text{J m}^{-3}\,\text{K}^{-4}$ and $\sigma_{\text{SB}} = 5.67\times10^{-8}\ \text{W m}^{-2}\,\text{K}^{-4}$ (U-26); the thermal term never carries the flux constant. The ledger of a film and of the slab carries once each the rest mass; in E/c^2

the heat the gradient adds, the energy of the drive current and, for the YIG, the held moments' $-\sum \mathsf{m} \cdot \mathsf{B}$ and E_{ind}; PV/c^2 at the ambient pressure, which T-3 and T-4 hold fixed; and aT^4V/c^2. No number is printed for an entry, binding is read from the solved geometry and never added as a local term, and thermal, isotope and pressure shifts are one mechanism through $\mathcal{M}$ and R_s (I-7).

The medium window: the thermal drive. In this analysis's reading, the source's "temperature gradient" (SC-043, L99–L100, right; SA-19) is a gradient of the clock factor of the films' conduction-electron medium, on the declared domain its enthalpy per count, and the source's transverse currents under that gradient — a transverse orbital current that, "In materials with orbital texture in the bulk or at the interface", it says "is also expected to arise through the ONE or ORNE upon a heat current flow" (SC-052, L100–L102, left; SA-15) [2], and "the spin Nernst effect (SNE), which generates a transverse spin current upon a heat current" (SC-054, L105–L106, left; SA-16) — are read in the medium window: "In a medium the same equation runs on the clock factor of 0.1c: the second derivatives of $\ln T$ set the deviation of the medium's patterns at the medium's own strength, while their gravitational window is small" (I-3a, "Three windows, one equation"). No number is taken from the clause.

I-3a and P-5: the transverse current and the applied field. "The deviation map $\nabla\mathcal{U}$ of a family of patterns splits into a trace (expansion: density, by continuity), an antisymmetric part (vorticity: the bivector grade, the mechanical circulation whose magnetic projection is that of P-5) and a symmetric trace-free part (shear: the tidal stretch and compression)" (I-3a). P-5 reads in full: "A magnetic field is a macroscopic helical density gradient of the omnium: the bivector grade of the density field coherently aligned along an axis; vortex lines are bivector topological defects. Imposing a physical twist (torsion, helical geometry) on a material *is* establishing a magnetic field; mechanical vorticity and magnetic moments are different grade projections of one density-gradient topography, with no carrier exchange (I-2). Quantitative twist → moment forms are derived in-manuscript through I-1/I-2 with a declared kernel" (P-5). In this analysis's reading, the source's transverse "orbital angular momentum flow" (SC-018, SC-019, L44–L45, left; SA-07) and its spin current are flows of the bivector grade — circulation — of the family of conduction electrons; where their drift under a drive along a film varies with depth, the family's deviation map has an antisymmetric part whose axis lies in the film plane across the current. The source takes from its Ref. 19 a "gradual depth-dependent oxygen distribution" for its CuO_x (SC-069, L134–L136, left; SA-24) [6] and, "As discussed in ref. 7", "the local Cu-O hybridization" as the key ingredient of the orbital texture (SC-026, SC-027, L39–L42, right; SA-10) [3], and prints no profile of its own films; the reading assigns the antisymmetric part no magnitude and no sign, and declares no kernel. In this analysis's reading, the source's applied field, applied along x or along y while the Seebeck voltage "is measured" (SC-089, L158–L159, left; SA-28), and the YIG magnetization are helical density gradients, and the sweep, whose "field range is sufficient to align" "the YIG magnetization" "along the in-plane field direction" (SC-091, L160–L161, left; SA-28), turns the YIG's held moments as a uniform twist does, pushing nothing.

0.1a: every step is a system-wide settlement. "The global optimisation is solved at every step, from the state the system is in; the expected behaviour is not necessarily the evolving system's optimum. Events do not commute, and a process run backward is never the mirror of the forward event. Responses are system-wide and many-to-many (I-5b's reclosure is one), never one-to-one, particle by particle; I-1's pair expression stays exact on its declared domain (I-1, I-4)" (0.1a). The source's stages — a transverse spin current "is generated", a transverse orbital current "is

expected to be generated", the orbital current "injects" into the Pt layer and "is converted" into additional spin current, the "total spin current" is "reflected" or "absorbed", and the reflected spin current "further converts" "back" to a charge current (SC-044 to SC-049, L101–L110, right; SA-19, SA-20) — and its "simplified drift-diffusion model" with its assumptions (SC-123 to SC-129, L219–L233, left; SA-44, SA-45) are the source's, attributed whole. In this analysis's reading, the stack's response to a drive is settled system-wide at every step; the conversion of a charge current into angular momentum at the YIG/Pt interface and that of angular momentum arriving there into a charge current are a process and its run backward, two settlements, each from its own starting state, and the source's model enters the direct conversion in CuO_x and leaves its inverse out, by its assumption (ii) (SA-45, SA-60).

2 System chart

The table below sets each object of the source beside the object of the core that reads it.

source object (rows)	core object	reading
polycrystalline YIG slab, typical $2 \times 10 \times 0.5$ mm (SC-064)	a closed pattern with a helical window (0.1b, 0.1c)	Reading: the field sweep is a helical density gradient that window reads (P-5)
Pt and CuO_x films, nominal 3 and 2 nm, the oxide's composition and depth profile unprinted (SC-060, SC-069)	media of closed braids with a conserved count (I-5, 0.1c)	Reading: their temperature gradient is a clock-factor gradient on the declared domain
temperature gradient, printed 1.9 ± 0.1 with the unit mm/K (SC-087; SA-27)	the medium's clock-factor gradient (0.1c, I-7)	Reading: a gradient of the enthalpy per count; no temperature difference is computed from the printed unit
charge current of 10 mA (SC-149); field swept from 700 to −700 Oe (SC-090, SC-150)	a drive; a helical density gradient (I-1, P-5)	Reading: the voltages are driven observables; the sweep turns the magnetization
spin and orbital currents (SC-044, SC-045); heat current (SC-077)	bivector-grade flows (I-3a, P-5); strokes of one carrier (I-2)	Reading: an antisymmetric part of the electrons' deviation map, unsized; phonons and magnons
sheet resistances, Seebeck coefficients, contrasts; angles, conductivities (SC-082, SC-156, SC-166; SC-102, SC-140, SC-190)	profile-weighted means; signed response coefficients (I-3, I-6)	Reading: thickness means, conductance-weighted for the sheet resistances and Seebeck coefficients and over the Pt within the spin diffusion length of the YIG/Pt interface for the contrasts; never an α, odds or bounded map
oxygen nuclei of the CuO_x	one pattern each, P-3's clamp (0.1b)	Reading: ^{18}O and ^{16}O differ by two two-strand closures

The slab's own gravitational window follows from its typical dimensions (SC-064, L122–L129, right), the density of U-22 and $F_{\max}$ (U-25): $R_s = \mathcal{M}c^2/(2F_{\max}) \approx 8 \times 10^{-32}$ m and, at the $r_f = 10$ mm of U-23, $\alpha_{\text{ext}} \approx 8 \times 10^{-30}$, one figure as the typical dimensions license; the small number is a correct reading (0.1c, I-1), and a film's window is written as a symbol only.

3 Observation map

The source's displays are flattened in its text and are never quoted: each is reconstructed here in this analysis's symbols and labelled a reconstruction. With $\mathfrak{l}_{\mathrm{sd}}$ the Pt spin diffusion length, $\mathfrak{r}_{\mathrm{Pt}}$ the Pt resistivity, $\mathfrak{g}_{\mathrm{r}}$ the spin-mixing conductance, $\mathfrak{d}_{\mathrm{Pt}}$ the Pt thickness, and tanh, coth and csch the hyperbolic tangent, cotangent and cosecant, the bookkeeping of the source's Eq. (1) to Eq. (4) carries an interface loading $\mathfrak{L}$ and a detection factor $\mathfrak{D}_{\mathrm{Pt}}$,

$$\mathfrak{L} = 2\,\mathfrak{l}_{\mathrm{sd}}\,\mathfrak{r}_{\mathrm{Pt}}\,\mathfrak{g}_{\mathrm{r}}, \qquad \mathfrak{D}_{\mathrm{Pt}} = \frac{\mathfrak{l}_{\mathrm{sd}}}{\mathfrak{d}_{\mathrm{Pt}}}\,\frac{\mathfrak{L}\tanh(\mathfrak{d}_{\mathrm{Pt}}/2\mathfrak{l}_{\mathrm{sd}})}{1+\mathfrak{L}\coth(\mathfrak{d}_{\mathrm{Pt}}/\mathfrak{l}_{\mathrm{sd}})}, \tag{9}$$

on the source's inputs $\mathfrak{l}_{\mathrm{sd}} = 1.5$ nm and $\mathfrak{g}_{\mathrm{r}} = 4\times10^{14}\ \Omega^{-1}\,\mathrm{m}^{-2}$, from its Ref. 12 and tagged literature (SC-096, SC-097, L160–L161, right; SA-35) [4], $\mathfrak{r}_{\mathrm{Pt}} = 60.8\ \mu\Omega\,\mathrm{cm}$, the sheet resistance times the nominal thickness (SC-100, L164, right; SA-55), and the nominal $\mathfrak{d}_{\mathrm{Pt}} = 3$ nm (SC-163, L224, right); there $\mathfrak{L} = 0.7$, at the one figure of $\mathfrak{g}_{\mathrm{r}}$ that every model angle inherits. The table below anchors each value to the source's equation or section with its row's verb class and sets beside it the value recomputed from the source's printed inputs through the reconstructions below, at the figures they license: the identity map of Use item 2. Its quantities are the thermopower and MR ratios, each contrast $\Delta\mathcal{S} = \mathcal{S}_{\mathrm{x}} - \mathcal{S}_{\mathrm{y}}$ or $\Delta\mathcal{R} = \mathcal{R}_{\mathrm{x}} - \mathcal{R}_{\mathrm{y}}$ between the field along x and along y over the Seebeck coefficient $\mathcal{S}$ or the sheet resistance $\mathcal{R}$; the oxide layer's sheet resistance $\mathcal{R}_{\mathrm{CuOx}}$ and Seebeck coefficient $\mathcal{S}_{\mathrm{CuOx}}$; the Pt layer's effective magneto-thermopower and MR ratios $\mathfrak{q}_{\mathrm{th}}$ and $\mathfrak{q}_{\mathrm{el}}$, the source's shunting estimates; and the angles and conductivities of the notation guard.

anchor; quantity	source (row)	class	recomputed
YIG/Pt(3); thermopower ratio	$(4.42 \pm 0.31)\times10^{-4}$ (SC-084)	derived	4.4×10^{-4}, two figures of $\Delta\mathcal{S}$
YIG/Pt(3); MR ratio	$(1.04 \pm 0.05)\times10^{-4}$ (SC-158)	derived	1.0×10^{-4}, two figures of $\Delta\mathcal{R}$
the stack; thermopower ratio	$(-1.46 \pm 0.09)\times10^{-3}$ (SC-118)	derived	-1.5×10^{-3}
the stack; MR ratio	$(1.59 \pm 0.10)\times10^{-4}$ (SC-168)	derived	1.6×10^{-4}
parallel model; $\mathcal{R}_{\mathrm{CuOx}}$, Ω	248.5 ± 35.7 (SC-171)	estimated	2.5×10^{2}
parallel model; $\mathcal{S}_{\mathrm{CuOx}}$, μV/K	-4.10 ± 0.61 (SC-214)	estimated	-4.1
shunting; $\mathfrak{q}_{\mathrm{th}}$	$(1.09 \pm 0.12)\times10^{-3}$ (SC-120)	estimated	1.1×10^{-3}
shunting; $\mathfrak{q}_{\mathrm{el}}$	$(2.88 \pm 0.45)\times10^{-4}$ (SC-173)	estimated	2.9×10^{-4}
$\mathfrak{q}_{\mathrm{th}}$ over the reference ratio	"about" "twice" (SC-121)	reading	2.5 ± 0.3, in quadrature
$\mathfrak{q}_{\mathrm{el}}$ over the reference ratio	"nearly a factor of three" (SC-174)	reading	2.8 ± 0.5, in quadrature
Eq. (3); Θ_{SH}, %	$+2.9 \pm 0.1$ (SC-165)	fitted	3, one figure of $\mathfrak{g}_{\mathrm{r}}$
Eq. (1); Θ_{SN}, %	-12.5 ± 1.0 (SC-102)	fitted	-1×10^{1}
Eq. (2); Θ_{ON}, %	$+22.5 \pm 6.8$ (SC-140)	estimated	2×10^{1}
Eq. (4); Θ_{OH}, %	$+11.8 \pm 3.6$ (SC-190)	estimated	1×10^{1}
Table 1; $\mathcal{N}_{\mathrm{SN}}$, $(\hbar/e)(\mathrm{A\,m^{-1}\,K^{-1}})$	-0.23 ± 0.02 (SC-103)	fitted	-0.23
Table 1; $\mathcal{C}_{\mathrm{SH}}$, $(\hbar/e)(\Omega^{-1}\,\mathrm{cm}^{-1})$	238.5 ± 13.5 (SC-211)	fitted	2.4×10^{2}
Eq. (2); $\mathcal{N}_{\mathrm{ON}}$, as $\mathcal{N}_{\mathrm{SN}}$	-0.93 ± 0.34 (SC-141)	estimated	-0.9
Eq. (4); $\mathcal{C}_{\mathrm{OH}}$, as $\mathcal{C}_{\mathrm{SH}}$	1187 ± 400 (SC-193)	estimated	1.2×10^{3}

3.1 Reference film and the two fits

For YIG/Pt(3) the source extracts the Seebeck coefficient $\mathcal{S}_{\mathrm{Pt}} = 2.240 \pm 0.006$ μV/K and $\Delta\mathcal{S} = \mathcal{S}_{\mathrm{x}} - \mathcal{S}_{\mathrm{y}} = 0.99 \pm 0.07$ nV/K (SC-082, SC-083, L146–L147, right; SA-33), every Seebeck coefficient

corrected: the contributions "from the connecting Cu wires" "must be subtracted" (SC-093, L165–L166, left; SA-29) [5]; and it reports the sheet resistance $\mathcal{R} = 202.5 \pm 9.1\ \Omega$ with $\Delta\mathcal{R} = \mathcal{R}_{\mathrm{x}} - \mathcal{R}_{\mathrm{y}} = 0.021 \pm 0.001\ \Omega$ (SC-156, SC-157, L218–L220, right; SA-53), each resistance a two-probe value times the sample's width over its length (SC-147, SC-148, L195–L199, right; SA-50). The source expresses the first ratio through "the SNMT model" of its Ref. 12 (SC-086, L148–L149, right; SA-34) and obtains the spin Hall angle "by fitting with the SMR model" of its Ref. 22 (SC-164, L225, right; SA-54) [7]; reconstructed, with Θ_{SN} and Θ_{SH} the spin Nernst and spin Hall angles of Pt, its Eq. (1) and Eq. (3) are

$$\frac{\Delta\mathcal{S}}{\mathcal{S}} = -\Theta_{\mathrm{SN}}\Theta_{\mathrm{SH}} \tanh\!\Big(\frac{\vartheta_{\mathrm{Pt}}}{2\ell_{\mathrm{sd}}}\Big)\mathfrak{D}_{\mathrm{Pt}}, \qquad \frac{\Delta\mathcal{R}}{\mathcal{R}} = \Theta_{\mathrm{SH}}^{2} \tanh\!\Big(\frac{\vartheta_{\mathrm{Pt}}}{2\ell_{\mathrm{sd}}}\Big)\mathfrak{D}_{\mathrm{Pt}}. \tag{10}$$

It obtains Θ_{SH}, fitted and "consistent with previous studies" (SC-165, L238–L239, right), and extracts Θ_{SN} with the conductivity $\mathcal{N}_{\mathrm{SN}}$, fitted and "consistent with our previous report" (SC-102 to SC-104, L166–L169, right; SA-35), the values of the table above; the conductance's flattened exponent is read as 10^{14} (SL-06, L161, right). Corroboration: no invariant — each value is the identity map of Use item 2 on the source's own inputs; precision: one figure for every model angle; falsifier: a recomputation that misses a printed value at its licensed figures.

3.2 The stack: parallel-resistance and shunting estimates

For YIG/Pt(3)/$\mathrm{CuO_x}$(2) the source finds that "the Seebeck coefficient for the whole sample" "changes sign" (SC-108, L186–L187, left) and reports $\mathcal{S}_{\mathrm{tot}} = -0.608 \pm 0.009\ \mu\mathrm{V/K}$ (SC-109, L188, left; SA-37), $\Delta\mathcal{S}_{\mathrm{tot}} = 0.89 \pm 0.09\ \mathrm{nV/K}$ (SC-117, L204–L205, left; SA-41), $\mathcal{R}_{\mathrm{tot}} = 111.6 \pm 6.7\ \Omega$, "reduced" "due to the conducting CuOx" (SC-166, L241–L242, right; SA-56), and $\Delta\mathcal{R}_{\mathrm{tot}} = 0.018 \pm 0.001\ \Omega$ (SC-167, L244, right). With $\mathcal{R}_{\mathrm{Pt}}$ and $\mathcal{S}_{\mathrm{Pt}}$ the reference film's values and $\mathcal{R}_{\mathrm{CuOx}}$ and $\mathcal{S}_{\mathrm{CuOx}}$ the oxide layer's, the source's "parallel-resistance model" (SC-110, L191, left; SC-169, L247, right; SA-38, SA-56) is reconstructed as

$$\frac{1}{\mathcal{R}_{\mathrm{tot}}} = \frac{1}{\mathcal{R}_{\mathrm{Pt}}} + \frac{1}{\mathcal{R}_{\mathrm{CuOx}}}, \qquad \frac{\mathcal{S}_{\mathrm{tot}}}{\mathcal{R}_{\mathrm{tot}}} = \frac{\mathcal{S}_{\mathrm{Pt}}}{\mathcal{R}_{\mathrm{Pt}}} + \frac{\mathcal{S}_{\mathrm{CuOx}}}{\mathcal{R}_{\mathrm{CuOx}}}, \tag{11}$$

through which "we estimate" $\mathcal{R}_{\mathrm{CuOx}}$ (SC-170, SC-171, L251–L254, right) and $\mathcal{S}_{\mathrm{CuOx}}$, "which shows the opposite sign to" that of Pt (SC-114, L198–L199, left; SA-38, SA-39), the Pt under $\mathrm{CuO_x}$ taken to keep the reference film's values. "If one assumes CuOx layer contributes only a shunting effect" (SC-119, L206–L208, left; SA-42), the source estimates the Pt layer's effective ratios, reconstructed, with $\mathfrak{q}_{\mathrm{th}}$ and $\mathfrak{q}_{\mathrm{el}}$ the effective magneto-thermopower and MR ratios (SC-172, L254–L258, right; SA-57), as

$$\mathfrak{q}_{\mathrm{th}} = \frac{\mathcal{R}_{\mathrm{Pt}}\big[\mathcal{R}_{\mathrm{tot}}\Delta\mathcal{S}_{\mathrm{tot}} + (\mathcal{S}_{\mathrm{Pt}} - \mathcal{S}_{\mathrm{tot}})\Delta\mathcal{R}_{\mathrm{tot}}\big]}{\mathcal{R}_{\mathrm{tot}}^{2}\,\mathcal{S}_{\mathrm{Pt}}}, \qquad \mathfrak{q}_{\mathrm{el}} = \frac{\Delta\mathcal{R}_{\mathrm{tot}}\,\mathcal{R}_{\mathrm{Pt}}}{\mathcal{R}_{\mathrm{tot}}^{2}}, \tag{12}$$

the first "about" "twice that obtained for YIG/Pt" (SC-121, L214–L215, left; SA-42) and the second "enhanced by nearly a factor of three relative to the reference Pt" sample (SC-174, L264–L265, right; SA-57). The source concludes that "the strongly enhanced spin-charge interconversion cannot be attributed solely to shunting and must originate from the ONE generated in the CuOx layer" (SC-122, L215–L217, left) and that "This pronounced enhancement clearly indicates that an additional angular-momentum contribution from the CuOx layer must be considered" (SC-176, L267–L270, right); both estimates read the Pt under $\mathrm{CuO_x}$ as the reference film. Corroboration: no invariant — each number is the identity map, and the conductance weight is the source's own parallel-resistance model, which returns the stack's data by construction once $\mathcal{R}_{\mathrm{CuOx}}$ and $\mathcal{S}_{\mathrm{CuOx}}$

are solved from them; I-3's observation-region rule is applied to these numbers as a reading, which none of them corroborates; precision: the printed uncertainties, which carry the sample length alone (SC-215, L349, table; SA-74); falsifier: a recomputation that misses a printed value at its licensed figures.

3.3 The model angles and conductivities of CuO_x

"To quantitatively analyze the orbital current generated by the CuOx layer, we apply a simplified drift-diffusion model" (SC-123, L219–L220, left; SA-44), with the assumptions "(i) immediate orbital-to-spin conversion at the Pt/CuOx interface, (ii) negligible inverse orbital Hall effect (IOHE) in CuOx, and (iii) strong spin relaxation within Pt due to its short spin diffusion length" (SC-126 to SC-128, L226–L233, left; SA-45). With $\mathfrak{r}_{\mathrm{CuOx}}$ the oxide's resistivity, $\mathcal{R}_{\mathrm{CuOx}}$ times its nominal thickness $\mathfrak{d}_{\mathrm{CuOx}}$, and Θ_{ON} and Θ_{OH} its orbital Nernst and orbital Hall angles, the source's Eq. (2) and, "Using similar assumptions", its Eq. (4) (SC-130, L235–L236, left; SC-183, L288–L289, left; SA-46, SA-60) are reconstructed as

$$\begin{aligned}
\mathfrak{q}_{\mathrm{th}} &= -\Big[\Theta_{\mathrm{SN}}\tanh\Big(\frac{\mathfrak{d}_{\mathrm{Pt}}}{2\mathfrak{l}_{\mathrm{sd}}}\Big) + \frac{\mathfrak{r}_{\mathrm{Pt}}\mathcal{S}_{\mathrm{CuOx}}}{\mathfrak{r}_{\mathrm{CuOx}}\mathcal{S}_{\mathrm{Pt}}}\Theta_{\mathrm{ON}}\operatorname{csch}\Big(\frac{\mathfrak{d}_{\mathrm{Pt}}}{\mathfrak{l}_{\mathrm{sd}}}\Big)\Big]\Theta_{\mathrm{SH}}\mathfrak{D}_{\mathrm{Pt}},\\
\mathfrak{q}_{\mathrm{el}} &= \Big[\Theta_{\mathrm{SH}}\tanh\Big(\frac{\mathfrak{d}_{\mathrm{Pt}}}{2\mathfrak{l}_{\mathrm{sd}}}\Big) + \frac{\mathfrak{r}_{\mathrm{Pt}}}{\mathfrak{r}_{\mathrm{CuOx}}}\Theta_{\mathrm{OH}}\operatorname{csch}\Big(\frac{\mathfrak{d}_{\mathrm{Pt}}}{\mathfrak{l}_{\mathrm{sd}}}\Big)\Big]\Theta_{\mathrm{SH}}\mathfrak{D}_{\mathrm{Pt}},
\end{aligned} \tag{13}$$

each a bracket of the forward conversions times one detection factor, that of Pt alone. The source prints no expression for a conductivity; with Θ a layer's angle, $\mathfrak{r}$ its resistivity and $\mathcal{S}$ its Seebeck coefficient, this analysis writes $\mathcal{C} = \Theta/(2\mathfrak{r})$ for a Hall pair and $\mathcal{N} = \Theta\mathcal{S}/(2\mathfrak{r})$ for a Nernst pair, the factor one-half its own (SA-48, SA-62), which return, from the source's printed angles, the four conductivities of the table above at the figures the source's printed uncertainties license. The source states that "The substantial enhancement of the effective magneto-thermopower ratio in the YIG/Pt/CuOx sample, therefore, provides strong evidence for the existence of the ONE in CuOx" (SC-142, L274–L277, left; SA-47) and that "we do not distinguish between the orbital" "Nernst effect originating from Cu and the orbital Rashba–Edelstein" "effect induced by the Cu-O hybridization", treating "the naturally oxidized CuOx as an effective single layer" (SC-143, SC-144, L278–L281, left; SA-49); its angles are effective angles of the oxidized layer as a whole, the orbital Nernst angle resting on assumptions (i) to (iii) and the orbital Hall angle on "similar assumptions" (SC-183, L288–L289, left). Corroboration: no invariant — the identity map; precision: one figure for every model angle; falsifier: a recomputation that misses a printed value at its licensed figures.

3.4 Thickness series, control film and uncertainties

At 5 nm of Pt the source estimates effective ratios it finds "comparable" to those of YIG/Pt(5), the differences $(-0.4 \pm 1.1) \times 10^{-4}$ and $(+0.2 \pm 0.5) \times 10^{-4}$ in quadrature (SC-201 to SC-206, L316–L327, right; SA-65); no input of either effective ratio at that thickness is printed. The control film YIG/CuO_x(5) shows, "within the same experimental" "resolution and with a comparable sheet resistance", a "negligible MR ratio" (SC-178, SC-179, L273–L275, right; SA-58), a bound on a 5-nm film whose Seebeck coefficient has the sign opposite to that of the 2-nm layer (SC-115, L200–L201, left; SA-40), which the source reads as "indicating that CuOx itself cannot efficiently generate a spin current to" "account for the enhanced MR for the YIG/Pt/CuOx sample" (SC-180, L276–L277, right). Every error bar of the source is "the propagated uncertainty from the sample length" (SC-215, L349, table; SA-66), an effective length of 9 ± 1 mm for a nominal 10 mm (SC-248, L425–L427, left; SA-74); no statistical and no model uncertainty is printed, and no threshold below is

built on these uncertainties, on the noise figures (SC-241, SC-242, L398–L401, right; SA-73) or on the "experimental" "resolution" (SC-178, L273–L274, right; SA-58). Its comparisons of size, "up to six" "times larger" (SC-229, L400–L401, left) and "up to an order of magnitude" "larger" (SC-231, L368–L369, right; SA-69), stand beside central quotients of 4 ± 2 for the Nernst and 5 ± 2 for the Hall conductivities and beside quotients of 6.0 and 7.1 at the edges of their printed uncertainties, and, for the Hall angles, beside 4 ± 1 and an edge quotient of 5.5; in this analysis's reading, "up to six" is the Nernst edge quotient and "up to an order of magnitude" exceeds both Hall edge quotients. Corroboration: no invariant — the identity map; precision: the printed uncertainties; falsifier: a recomputation that misses a printed value.

4 Cone-position translation

In this analysis's reading, the conduction electrons of the source's films are closed $n = 3$ braids (I-5): their class — charge magnitude $Q = n \bmod 2$ — is fixed by the strand count, and their mass by a confinement position on the A-4 axis, a token with no value (O-3); the electron and the proton are the same $n = 3$ closure read from the free room and from the nuclear room, and no form of the operator that sets their mass ratio is written here (O-9). The fermion class of each braid, the nested turning-class degree, is $\nu_F = B_s \bmod 2$, distinct from the charge-magnitude rule $Q = n \bmod 2$; once that class is nontrivial the identity $\kappa F_{\max} = 2\pi$ normalises its character to $\exp(i\kappa F_{\max}/2) = -1$ with no fitted parameter, and neither a proof that the class is nontrivial nor a form of ν_F on the exact framed closures is written here (O-11). The source's "orbital degree of freedom" (SC-023, L53, left) and its "spin" (SC-048, L107–L108, right) stay its words: no strand count and no α is assigned to either, and no address on any chart is printed for any named particle. In this analysis's reading, the nuclei of ^{18}O and ^{16}O are two patterns that differ by two $n = 2$ closures, the neutron as I-5 lists it, and no form of D is written for either (O-9); each sits at the tip of its density cone as a gravitating source, where energy and density are both maximal, its local profile densest at its skin on both branches and dilute at its centre (I-3, 0.6), and no form of the local profile is written here (O-4).

5 Predictions

The five blocks T-1 to T-5 are predictions general relativity and quantum mechanics do not make: each stands where a core clause supplies what the consensus calculation lacks — an additional source (P-5: T-1, T-2), a constitutive input (I-7: T-3, T-4) or a changed observable dictionary (0.1a: T-5) — while the convergence statement recovers the consensus data on the source's own inputs (Use item 2). Every candidate becomes a block, and none is retired. T-1, T-2 and T-5 are existence predictions and T-3 and T-4 sign predictions: for each block the core supplies the existence of its effect or, for T-3 and T-4, the input sign of its density channel, the observable direction there being this analysis's reading, and no kernel for its size.

Common definitions. On samples made and measured as the source describes (SA-22, SA-24, SA-29, SA-50) unless a design says otherwise, $\mathcal{R}$ is a sheet resistance and $\Delta\mathcal{R} = \mathcal{R}_{\mathrm{x}} - \mathcal{R}_{\mathrm{y}}$ its contrast between the field along x and along y (SA-53); $\mathcal{S}$ is a Seebeck coefficient and $\Delta\mathcal{S} = \mathcal{S}_{\mathrm{x}} - \mathcal{S}_{\mathrm{y}}$ (SA-36); for a stack of Pt and CuO_x beside a bare Pt region of the same slab, $\mathfrak{q}_{\mathrm{th}}$ and $\mathfrak{q}_{\mathrm{el}}$ are the source's two shunting estimates of the Pt layer's effective ratios, Eq. (12) (SA-42, SA-57), with $\mathcal{R}_{\mathrm{Pt}}$ and $\mathcal{S}_{\mathrm{Pt}}$ those of the bare region.

Decision rules and ablation. The sizes are exact: of the $2^{12} = 4096$ equally likely sign assignments of twelve values, $p \leq 0.0027$ two-sided admits the 10 most extreme ($10/4096 = 0.0024$) and $p \leq 0.00135$ one-sided the 5 most extreme ($5/4096 = 0.0012$); twelve and both levels are investigator-chosen (U-01 to U-03). Each decision uses the permutation distribution of its block's own twelve values, so no normal-theory variance and no covariance enters a size, and no Monte Carlo figure and no power is printed. Two tests are common to T-1, T-2 and T-5, for twelve values with a bound $\mathfrak{b}$ and a scale $\mathfrak{h}$. The bounded test: the mean lies outside the interval from $-\mathfrak{b}$ to $+\mathfrak{b}$ and the two-sided test of the values, every one shifted by $\mathfrak{b}$ against the sign of the mean, rejects at $p \leq 0.0027$ (with no FDT term its probability is at most $10/4096$ wherever the bounded term lies within its bound). The exclusion test: a term of magnitude $\mathfrak{h}$ or more is excluded when $\mathfrak{b} < \mathfrak{h}$, the mean lies between $-(\mathfrak{h} - \mathfrak{b})$ and $+(\mathfrak{h} - \mathfrak{b})$, and the two-sided tests of the values shifted by $+(\mathfrak{h} - \mathfrak{b})$ and by $-(\mathfrak{h} - \mathfrak{b})$ both reject at $p \leq 0.0027$ (false exclusion at most $5/4096$ wherever the bounded term lies within its bound). Each block's ablation is an instantiated effect, never a derived amplitude: with the FDT input in place every one of the twelve values stands at the block's scale above the comparator's value, and with the input ablated at the comparator's value; the threshold is the mean that one sign flip among the twelve equal values the rule tests leaves short of rejection.

5.1 T-1: a twist read on YIG in zero applied field

This block carries candidate DC-1 and discriminates SA-75: the source writes that "This field range is sufficient to align" "the YIG magnetization" "along the in-plane field direction" (SC-091, L160–L161, left; SA-75), the range of the field it applies, and P-5 supplies an additional source that the consensus calculation lacks, its clauses "A magnetic field is a macroscopic helical density gradient of the omnium" and "Imposing a physical twist (torsion, helical geometry) on a material *is* establishing a magnetic field", read here in no applied field at all.

Referent and observable. An element of the source's polycrystalline YIG (SC-237, L386–L387, right) cut as a truncated cone, end-diameter ratio 2, wide end down (U-04, investigator-chosen), its upper face alone coated as the source coats its YIG/Pt(3) sample (SA-22), with four contacts 1, 2, 3, 4 in order round the edge of the film, inside a magnetic shield (external; U-13), in a non-magnetic torsion clamp that carries no current and turns the element's two ends by $+\mathfrak{w}/2$ and $-\mathfrak{w}/2$ about its axis, the film normal, with $\mathfrak{w} = \pm 0.1°$, its sign the hand (U-05, investigator-chosen for an element that takes it elastically). A uniformly twisted element of uniform circular section, coated on neither end face or on both, carries no net axial field, because a twofold axis across the element keeps the twist and reverses an axial field; the design therefore tapers the element and coats one end face. With $\mathcal{R}_{13,24}$ and $\mathcal{R}_{24,13}$ each term its third contact's potential less its fourth's over an alternating current sent from its first to its second — the former a current from the first contact to the third and the potential of the second less that of the fourth, the latter a current from the second contact to the fourth and the potential of the first less that of the third — read at the drive frequency where it does not depend on the current (U-06), $\mathcal{R}_{\mathrm{odd}}(\pm)$ the reciprocity-odd resistance at the hand $\pm$, $\mathcal{P}$ the pattern of magnetization and applied field, B_{ax} the axial part of the twist's field, $\mathfrak{y}_{\mathrm{tw}}$ the per-session contrast and $\mathfrak{y}_{\mathrm{fld}}$, $\mathfrak{y}_{\mathrm{dom}}$, $\mathfrak{y}_{\mathrm{dr}}$, $\mathfrak{y}_{\mathrm{amb}}$ its terms from the twist's field, the residual domain state, a drift between the two readings and the ambient leak, the observable and its defining condition, solved, are

$$\begin{aligned} \mathcal{R}_{\mathrm{odd}} &= \frac{1}{2}\big(\mathcal{R}_{13,24} - \mathcal{R}_{24,13}\big), \qquad \mathfrak{y}_{\mathrm{tw}} = \frac{1}{2}\big[\mathcal{R}_{\mathrm{odd}}(+) - \mathcal{R}_{\mathrm{odd}}(-)\big], \\ \mathcal{R}_{13,24}[\mathcal{P}] = \mathcal{R}_{24,13}[-\mathcal{P}] &\implies \mathcal{R}_{\mathrm{odd}}[-\mathcal{P}] = -\mathcal{R}_{\mathrm{odd}}[\mathcal{P}], \quad \mathcal{R}_{\mathrm{odd}}[0] = 0, \\ \mathsf{B}_{\mathrm{ax}}(-\mathfrak{w}) = -\mathsf{B}_{\mathrm{ax}}(+\mathfrak{w}) &\implies \mathfrak{y}_{\mathrm{tw}} = \mathfrak{y}_{\mathrm{fld}} + \mathfrak{y}_{\mathrm{dom}} + \mathfrak{y}_{\mathrm{dr}} + \mathfrak{y}_{\mathrm{amb}}, \end{aligned} \tag{14}$$

each term signed as the channel table signs it. Its scale $\mathcal{R}_{\mathrm{sat}}$ is half the difference of $\mathcal{R}_{\mathrm{odd}}$ between the two senses of one saturating field along the axis, both fixed before the first session (U-07).

Design and FDT input. Twelve sessions (U-01); in each session $\mathcal{R}_{\mathrm{odd}}$ is read at the hand + and at the hand −, in an order set by a fair coin drawn before the session, which randomises the sign of a drift between the two readings, and before each of the two readings, its hand already set, the element is degaussed inside the shield by a decaying alternating field that starts above its saturation field and whose starting polarity is set by a fair coin of its own drawn before the session, which randomises the sign of the residual domain state at that reading and leaves that state the same whichever hand is read first; per session the contrast is $\mathfrak{y}_{\mathrm{tw}}$. By P-5 the imposed twist establishes a magnetic field; the mirror through a plane that contains the element's axis reverses the hand and an axial field and keeps the taper and the coated face, so the field's axial part is odd in the hand; a field along the film normal magnetizes the YIG along it and so gives the Pt film a reciprocity-odd resistance (consensus data, external; the source prints the in-plane alignment only, SA-28). P-5's last sentence, "Quantitative twist → moment forms are derived in-manuscript through I-1/I-2 with a declared kernel", assigns neither magnitude nor sense, and no kernel is declared here: an existence prediction. The block reads a helical density gradient as Use item 7 requires: the contrast compares the element at its two hands, and the consensus term vanishes by reciprocity where the pattern of magnetization and applied field is null, the comparator's zero.

Comparator and channels. Zero within the ambient leak. In the consensus calculation, the reciprocal relations of linear transport (external), $\mathcal{R}_{13,24}$ of a conductor at one pattern of magnetization and applied field equals $\mathcal{R}_{24,13}$ at the reversed pattern, whatever its shape, strain and twist: $\mathcal{R}_{\mathrm{odd}}$ is odd under that reversal and vanishes where the pattern is null (Use item 7). A uniform ambient field left by the shield enters the contrast through terms odd in the hand, bounded by $\mathfrak{b}_{\mathrm{amb}}$, fixed before the first session from the measured response of the contrast to uniform test fields along three axes, each held through both degaussings and both readings, and from the shield's measured residual (U-08); the first session starts only with $\mathfrak{b}_{\mathrm{amb}}$ at or under its design ceiling $0.04\,\mathcal{R}_{\mathrm{sat}}$ (U-09, investigator-chosen). Each channel and the sign it gives the contrast are in the table below.

channel	sign it gives $\mathfrak{y}_{\mathrm{tw}}$
the twist's field, $\mathfrak{y}_{\mathrm{fld}}$	one sign in every session, its sense unassigned; the test is two-sided
the residual domain state, $\mathfrak{y}_{\mathrm{dom}}$, with all the taper, the twist, the strain and the torsion clamp do through it	signs the two degaussing coins set, one at each reading
a drift between the readings, $\mathfrak{y}_{\mathrm{dr}}$	a sign the order coin sets
the ambient leak, $\mathfrak{y}_{\mathrm{amb}}$	one sign in every session, inside the interval from $-\mathfrak{b}_{\mathrm{amb}}$ to $+\mathfrak{b}_{\mathrm{amb}}$
everything else the taper, the twist, the strain and the torsion clamp do	zero in the comparator, by its reciprocity

Statistic, decision rules and ablation. The statistic is the twelve contrasts, with a two-sided sign-flip permutation test over all 4096 flips, the bound $\mathfrak{b} = \mathfrak{b}_{\mathrm{amb}}$ and the scale $\mathfrak{h} = \mathfrak{h}_{\mathrm{tw}} = 0.1\,\mathcal{R}_{\mathrm{sat}}$ (U-10, investigator-chosen). Detection — the plain two-sided test of the twelve contrasts rejects at $p \le 0.0027$ (U-02; size 10/4096 with no twist field and no ambient leak: the sign of every other term is a fair coin's or a symmetric reading error's); attribution — a detection is read as the field P-5 assigns to the imposed twist when the bounded test also holds; exclusion — the exclusion test;

inconclusive otherwise. Ablation test point: with the bound at its design ceiling, $\mathfrak{b}_{\mathrm{amb}} = 0.04\,\mathcal{R}_{\mathrm{sat}}$ (U-09), the values are $\mathfrak{h} = 0.1\,\mathcal{R}_{\mathrm{sat}}$ against zero, the bounded test's shifted values $\mathfrak{h} - \mathfrak{b} = 0.06\,\mathcal{R}_{\mathrm{sat}}$, and the threshold $\mathfrak{b} + 5(\mathfrak{h} - \mathfrak{b})/6 = 0.09\,\mathcal{R}_{\mathrm{sat}}$; the difference of $0.1\,\mathcal{R}_{\mathrm{sat}}$ exceeds it, so the decision rule separates the FDT input from its ablation.

5.2 T-2: the same twist read on a non-magnetic garnet

This block carries candidate DC-2 and discriminates SA-76: the source writes that "The use of an insulating ferromagnet eliminates any" anisotropic magnetoresistance or anomalous Nernst contributions (SC-042, L121, left), "ensuring that the observed signal arises solely from the nonmagnetic" "metallic layers" (SC-041, L97–L98, right; SA-76); P-5 supplies the additional source of T-1, and here the twist's field threads the Pt film itself on a garnet that holds no magnetization.

Referent, design and observable. Referent, observable, channels and statistic are those of T-1, on an element of the same shape cut from a non-magnetic garnet, yttrium aluminium garnet (U-11, investigator-chosen), coated and contacted as there. The element holds no magnetization: no degaussing, no degaussing coin and no residual-domain channel; twelve sessions with the order coin (U-01). Its scale $\mathcal{R}_{\mathrm{cal}}$ is half the difference of $\mathcal{R}_{\mathrm{odd}}$ between the two senses of a test field of 1 mT along the axis, fixed before the first session (U-12, investigator-chosen); with the terms of T-1 and $\mathfrak{y}_{\mathrm{nm}}$ the per-session contrast,

$$\mathfrak{y}_{\mathrm{nm}} = \frac{1}{2}\big[\mathcal{R}_{\mathrm{odd}}(+) - \mathcal{R}_{\mathrm{odd}}(-)\big] = \mathfrak{y}_{\mathrm{fld}} + \mathfrak{y}_{\mathrm{dr}} + \mathfrak{y}_{\mathrm{amb}}, \tag{15}$$

its leak inside a $\mathfrak{b}_{\mathrm{amb}}$ fixed as in T-1, each field held through the readings, at or under $0.04\,\mathcal{R}_{\mathrm{cal}}$ (U-09).

FDT input, comparator and channels. The twist's field, as in T-1, threads the Pt film itself, whose Hall resistance in a field along its normal is consensus data (external): an existence prediction, with no kernel declared. The comparator is zero within the ambient leak, by the reciprocity of T-1's comparator for a conductor with no magnetization in no applied field. Each channel and its sign are in the table below.

channel	sign it gives $\mathfrak{y}_{\mathrm{nm}}$
the twist's field, $\mathfrak{y}_{\mathrm{fld}}$	one sign in every session, its sense unassigned; the test is two-sided
a drift between the readings, $\mathfrak{y}_{\mathrm{dr}}$	a sign the order coin sets
the ambient leak, $\mathfrak{y}_{\mathrm{amb}}$	one sign in every session, inside the interval from $-\mathfrak{b}_{\mathrm{amb}}$ to $+\mathfrak{b}_{\mathrm{amb}}$
everything else the taper, the twist, the strain and the torsion clamp do	zero in the comparator, by its reciprocity

Statistic, decision rules and ablation. The statistic is the twelve contrasts, with a two-sided sign-flip permutation test over all 4096 flips, the bound $\mathfrak{b} = \mathfrak{b}_{\mathrm{amb}}$ and the scale $\mathfrak{h} = \mathfrak{h}_{\mathrm{tw}} = 0.1\,\mathcal{R}_{\mathrm{cal}}$ (U-10, investigator-chosen). Detection — the plain two-sided test of the twelve contrasts rejects at $p \le 0.0027$ (U-02; size 10/4096 with no twist field and no ambient leak: the sign of every other term is a fair coin's or a symmetric reading error's); attribution — a detection is read as the field P-5 assigns to the imposed twist when the bounded test also holds; exclusion — the exclusion test; inconclusive otherwise. Ablation test point: with $\mathfrak{b}_{\mathrm{amb}} = 0.04\,\mathcal{R}_{\mathrm{cal}}$ (U-09) at its design ceiling,

the values are $\mathfrak{h} = 0.1\,\mathcal{R}_{\mathrm{cal}}$ against zero, the bounded test's shifted values $\mathfrak{h} - \mathfrak{b} = 0.06\,\mathcal{R}_{\mathrm{cal}}$, and the threshold $\mathfrak{b} + 5(\mathfrak{h} - \mathfrak{b})/6 = 0.09\,\mathcal{R}_{\mathrm{cal}}$; the difference of $0.1\,\mathcal{R}_{\mathrm{cal}}$ exceeds it, so the decision rule separates the FDT input from its ablation.

5.3 T-3: the oxygen isotope read on the thermal enhancement

This block carries candidate DC-3 and discriminates SA-77: the source writes of its estimate of the Pt layer's effective magneto-thermopower ratio that "This value is about" "twice that obtained for YIG/Pt" (SC-121, L214–L215, left; SA-77), a quotient its shunting estimate fixes and its model reads through one angle of CuO_x; I-7 supplies a constitutive input that the consensus calculation lacks, its Discriminator, quoted whole: "For purely density-coupled equilibrium observables, a heavier isotope $\rightarrow$ larger R_s $\rightarrow$ higher α $\rightarrow$ *larger* response — opposite in sign to conventional reduced-mass scaling" (I-7).

Referent and design. Twelve slabs of the source's YIG (U-01), each coated with Pt(3) over its whole face and, through a mask in one run, with the Cu of the source's CuO_x(2) layer over two of three strips along its length (SA-22, SA-24), then cut along its length, with no exposure to air (U-14, external handling), into a bare-Pt bar and two Cu-coated bars, the latter oxidized for the source's two days (SC-068, L132–L133, left) in two cells of one design at one temperature, one filled with air made from oxygen enriched to at least 95 % in ^{18}O (U-15, investigator-chosen), the other with air made from natural oxygen, then capped in one run as the source caps (SC-070, L136–L137, left). A fair coin drawn before the cut assigns the two bars to the two cells and a second, drawn before each pair's oxidation, the two airs to the cells, which randomise the signs of a gradient of the deposit across the slab and of a difference between the cells; the two bars of a pair are read in turn in one set-up, in an order set by a third fair coin drawn before the pair's first reading, which randomises the sign of a drift between the two readings.

Observable and FDT input. With $\mathfrak{q}_{\mathrm{th}}$ formed per bar with the pair's bare-Pt bar, the superscripts naming a bar's oxygen isotope, $\mathfrak{y}_{\mathrm{th}}$ the pair difference, x_i the coordinate of channel i, S_i the sensitivity of $\ln \mathfrak{q}_{\mathrm{th}}$ to $\ln x_i$ with every other coordinate held fixed, the integral, its limits naming the two isotopes, a line integral from the coordinates of the lighter isotope's bar to those of the heavier's along any path, each S_i evaluated where the path stands, which $\sum_i S_i\, d\ln x_i = d\ln \mathfrak{q}_{\mathrm{th}}$ makes independent of the path, and Δ the finite isotope change, the observable and its defining condition are

$$\mathfrak{y}_{\mathrm{th}} = \ln \mathfrak{q}_{\mathrm{th}}^{18} - \ln \mathfrak{q}_{\mathrm{th}}^{16}, \qquad \Delta \ln \mathfrak{q}_{\mathrm{th}} = \int_{16}^{18} \sum_i S_i\, d\ln x_i, \qquad S_i = \frac{\partial \ln \mathfrak{q}_{\mathrm{th}}}{\partial \ln x_i}, \tag{16}$$

the sum running over the density channel and the geometric, electronic and inertial channels, as I-7's Discipline 2 requires: "A sign prediction competing with geometric, electronic or inertial channels is written as a sensitivity-weighted sum $\delta \ln O = \sum_i S_i\, \delta \ln x_i$ with every S_i defined (held-fixed variables stated). The density-channel *input* sign is the FDT discriminator; the *observable* sign is $\mathrm{sgn}(\prod S_i)$", fixed only once the sensitivities are established (I-7). The density channel's x is an A-1 α_{ext} of the chart inventory, on the exterior branch, its object the oxidized layer's own window, moved by the substitution through $\mathcal{M}$ at fixed P, r_f and packing: "Fixed-geometry perturbations (isotope substitution: P, r, packing all fixed) move compactness only; pressure-trajectory maps do not apply to them" (I-3 chart discipline 5). The layer's $\mathcal{M}$ is built from its composition and the oxygen isotope's mass, never from $\mathfrak{q}_{\mathrm{th}}$ (I-7 Discipline 3), and the heavier isotope's zero-point lattice

energy is an E/c^2 entry of that $\mathcal{M}$, entered once. In this analysis's reading, the Discriminator's "*larger* response" is a larger $\mathfrak{q}_{\mathrm{th}}$, and $\mathfrak{q}_{\mathrm{th}}$, a quotient of linear responses, independent of the drives' sizes, is an "equilibrium" observable and not "purely density-coupled": its geometric, electronic and inertial channels are the other terms of Discipline 2's sum, and its observable sign, $\mathrm{sgn}(\prod S_i)$, is fixed once the sensitivities are established; T-3's one-sided rules take it as positive on this reading, and T-3 is a sign prediction.

Comparator and channels. Each pair's consensus isotope shift of $\ln \mathfrak{q}_{\mathrm{th}}$ — the oxidation kinetics, the phonon channel of conventional reduced-mass scaling, the heavier isotope's zero-point lattice change, and that pair's residual composition, thickness and microstructure differences — lies inside the preregistered interval from $-\mathfrak{c}_{\mathrm{iso}}$ to $+\mathfrak{c}_{\mathrm{iso}}$, $\mathfrak{c}_{\mathrm{iso}} = 0.01$ (U-16, investigator-chosen); reduced-mass scaling enters only here, as a comparator channel. Each channel and its sign are in the table below.

channel	sign it gives $\mathfrak{y}_{\mathrm{th}}$
the density channel	input sign positive (the Discriminator); Reading: its sign here is this analysis's reading
the consensus channels	either sign; each pair's sum inside the interval from $-\mathfrak{c}_{\mathrm{iso}}$ to $+\mathfrak{c}_{\mathrm{iso}}$
the shift of $\mathfrak{q}_{\mathrm{el}}$, for $\mathfrak{y}_{\mathrm{th}}$ alone	none: $\mathfrak{q}_{\mathrm{th}}$'s term in $\Delta\mathcal{R}_{\mathrm{tot}}$ cancels what that shift moves in $\Delta\mathcal{S}_{\mathrm{tot}}$ (the parallel-resistance model)
the deposit gradient, the cell difference and the reading drift	signs the three coins set

Statistic, decision rules and ablation. The statistic is the twelve pair differences, with one-sided sign-flip permutation tests over all 4096 flips. Detection — the one-sided test of the pair differences less $\mathfrak{c}_{\mathrm{iso}}$ rejects upward at $p \le 0.00135$ (U-03; size at most 5/4096 wherever every pair's consensus shift lies in the interval); exclusion — a density-channel contribution of $\mathfrak{h}_{\mathrm{iso}} = 0.05$ or more in the logarithm (U-17, investigator-chosen) is excluded when the one-sided test of the pair differences less $(\mathfrak{h}_{\mathrm{iso}} - \mathfrak{c}_{\mathrm{iso}})$ rejects downward at $p \le 0.00135$ (U-03; false exclusion at most 5/4096 on the same condition); inconclusive otherwise; attribution — a detection is read as the density channel when it stands with $\mathfrak{c}_{\mathrm{iso}}$ kept for the phonon and the zero-point channels and added to the bound recomputed from the pairs' measured sheet resistances, oxide depths and compositions (external), each propagated through a sensitivity measured on bars oxidized in natural oxygen before the first pair. Ablation test point: with the comparator's value at the interval's upper end, the values are $\mathfrak{c}_{\mathrm{iso}} + \mathfrak{h}_{\mathrm{iso}} = 0.06$ against $\mathfrak{c}_{\mathrm{iso}} = 0.01$, the residuals $\mathfrak{h}_{\mathrm{iso}} = 0.05$ against zero, and the threshold $5\mathfrak{h}_{\mathrm{iso}}/6 = 0.0417$; the difference of 0.05 exceeds it, so the decision rule separates the FDT input from its ablation.

5.4 T-4: the oxygen isotope read on the electrical enhancement

This block carries candidate DC-4 and discriminates SA-78: the source writes that "The MR ratio" "is enhanced by nearly a factor of three relative to the reference Pt" sample (SC-173, SC-174, L262–L265, right; SA-78); I-7 supplies the constitutive input of T-3, the Discriminator.

Referent, design, observable and FDT input. Referent, design, comparator, interval, channels and statistic are those of T-3, on the same twelve pairs; with $\mathfrak{y}_{\mathrm{el}}$ the pair difference and the

rest as in Eq. (16), the observable is $\ln \mathfrak{q}_{\mathrm{el}}$ per bar and

$$\mathfrak{y}_{\mathrm{el}} = \ln \mathfrak{q}_{\mathrm{el}}^{18} - \ln \mathfrak{q}_{\mathrm{el}}^{16}, \qquad \Delta \ln \mathfrak{q}_{\mathrm{el}} = \int_{16}^{18} \sum_i S_i \, d \ln x_i, \tag{17}$$

with the FDT input of T-3 and $\mathfrak{q}_{\mathrm{el}}$ in place of $\mathfrak{q}_{\mathrm{th}}$: the density channel's x an A-1 α_{ext} of the oxidized layer, moved through $\mathcal{M}$ at fixed P, r_f and packing; in this analysis's reading the Discriminator's "*larger* response" is a larger $\mathfrak{q}_{\mathrm{el}}$, a quotient of linear responses and not "purely density-coupled"; a sign prediction, its one-sided rules taking the observable sign as positive on that reading. T-3 and T-4 run on the same pairs; each decision uses its own twelve pair differences and its own exact size, and no joint decision is formed from the two.

Comparator, channels, decision rules and ablation. Each pair's consensus isotope shift of $\ln \mathfrak{q}_{\mathrm{el}}$ lies inside the interval from $-\mathfrak{c}_{\mathrm{iso}}$ to $+\mathfrak{c}_{\mathrm{iso}}$, $\mathfrak{c}_{\mathrm{iso}} = 0.01$ (U-16); each channel and its sign are in the table below.

channel	sign it gives $\mathfrak{y}_{\mathrm{el}}$
the density channel	input sign positive (the Discriminator); Reading: its sign here is this analysis's reading
the consensus channels	either sign; each pair's sum inside the interval from $-\mathfrak{c}_{\mathrm{iso}}$ to $+\mathfrak{c}_{\mathrm{iso}}$
the deposit gradient, the cell difference and the reading drift	signs the three coins set

Detection — the one-sided test of the pair differences less $\mathfrak{c}_{\mathrm{iso}}$ rejects upward at $p \le 0.00135$ (U-03; size at most 5/4096 wherever every pair's consensus shift lies in the interval); exclusion — a density-channel contribution of $\mathfrak{h}_{\mathrm{iso}} = 0.05$ or more in the logarithm (U-17, investigator-chosen) is excluded when the one-sided test of the pair differences less $(\mathfrak{h}_{\mathrm{iso}} - \mathfrak{c}_{\mathrm{iso}})$ rejects downward at $p \le 0.00135$ (U-03; false exclusion at most 5/4096 on the same condition); inconclusive otherwise; attribution — a detection is read as the density channel when it stands with $\mathfrak{c}_{\mathrm{iso}}$ kept for the phonon and the zero-point channels and added to the bound recomputed from the pairs' measured sheet resistances, oxide depths and compositions (external), each propagated through a sensitivity measured on bars oxidized in natural oxygen before the first pair. Ablation test point: with the comparator's value at the interval's upper end, the values are $\mathfrak{c}_{\mathrm{iso}} + \mathfrak{h}_{\mathrm{iso}} = 0.06$ against $\mathfrak{c}_{\mathrm{iso}} = 0.01$, the residuals $\mathfrak{h}_{\mathrm{iso}} = 0.05$ against zero, and the threshold $5\mathfrak{h}_{\mathrm{iso}}/6 = 0.0417$; the difference of 0.05 exceeds it, so the decision rule separates the FDT input from its ablation.

5.5 T-5: a conversion and its inverse read on one slab

This block carries candidate DC-5 and discriminates SA-79: the source's model makes the assumption "(ii) negligible inverse orbital Hall effect (IOHE) in CuOx" (SC-127, L227–L229, left; SA-79), so that CuO_x enters the forward conversion and leaves its inverse out; 0.1a supplies a changed observable dictionary, its sentence "Events do not commute, and a process run backward is never the mirror of the forward event", with, in this analysis's reading, a conversion and its inverse as two settlements.

Referent and design. Twelve slabs of the source's YIG (U-01), each coated with Pt(3) over its whole face and with the source's CuO_x(2) over one half of its length — the half set by a fair coin drawn before the deposition, which randomises the sign of a gradient along the slab — capped

as the source caps (SC-070, L136–L137, left), the two halves contacted through one mask (U-18). On each half: $\mathcal{R}$ and $\Delta\mathcal{R}$, as the source measures them (SA-53, SA-56); and $\mathcal{V}_{\mathrm{as}}$, the part of the thermovoltage antisymmetric in the field, whose value the source does not print and which its "out-of-plane heat current generates", "due to the spin" "Seebeck effect of YIG" (SC-079, L147–L149, left; SA-26), the two halves heated through the slab's thickness by one heater in one run, the half read first set by a second fair coin drawn before the run, which randomises the sign of a drift.

Observable. With the subscripts ox and bare naming the half with $\mathrm{CuO_x}$ and the bare half, $\mathcal{R}_{\mathrm{tp}}$ a half's two-probe resistance between its voltage contacts, $\mathfrak{E}_{\mathrm{el}}$ the quotient of the two halves' sheet-conductance changes — the source's effective MR ratio over its reference ratio (SA-57) — and $\mathfrak{E}_{\mathrm{inv}}$ the quotient of the charge currents the two halves return, the observable $\mathfrak{y}_{\mathrm{rec}}$ is

$$\mathfrak{E}_{\mathrm{el}} = \frac{(\Delta\mathcal{R}/\mathcal{R}^2)_{\mathrm{ox}}}{(\Delta\mathcal{R}/\mathcal{R}^2)_{\mathrm{bare}}}, \qquad \mathfrak{E}_{\mathrm{inv}} = \frac{(\mathcal{V}_{\mathrm{as}}/\mathcal{R}_{\mathrm{tp}})_{\mathrm{ox}}}{(\mathcal{V}_{\mathrm{as}}/\mathcal{R}_{\mathrm{tp}})_{\mathrm{bare}}}, \qquad \mathfrak{y}_{\mathrm{rec}} = \ln \mathfrak{E}_{\mathrm{el}} - 2 \ln \mathfrak{E}_{\mathrm{inv}}. \tag{18}$$

FDT input and comparator. In this analysis's reading (0.1a), a charge current's conversion into angular momentum and its inverse are two settlements, so the factor by which the $\mathrm{CuO_x}$ multiplies the forward conversion is not bound to that by which it multiplies the inverse: an existence prediction, its sense unassigned. The comparator is $\mathfrak{y}_{\mathrm{rec}}$ inside the preregistered interval from $-\mathfrak{c}_{\mathrm{rec}}$ to $+\mathfrak{c}_{\mathrm{rec}}$, $\mathfrak{c}_{\mathrm{rec}} = 0.05$ (U-19, investigator-chosen). In the consensus account — reciprocity (external), in the bookkeeping of the source's Eq. (3) and Eq. (4) (SA-54, SA-60) — a half's sheet-conductance change is its forward factor times its inverse factor over its interface loading $1 + \mathfrak{L}_{\mathfrak{z}}$, and the current it returns from the heated YIG is its inverse factor times the heat flux through it over the same loading, with $\mathfrak{z} = \coth(\mathfrak{d}_{\mathrm{Pt}}/\mathfrak{l}_{\mathrm{sd}})$ for a Pt upper face that passes no spin current and $\mathfrak{z} = \tanh(\mathfrak{d}_{\mathrm{Pt}}/\mathfrak{l}_{\mathrm{sd}})$ for one that absorbs it all. With $\mathfrak{u}$ and $\mathfrak{v}$ a half's forward and inverse factors and $\mathfrak{p}$ the quotient of the heat flux through the half with $\mathrm{CuO_x}$ over that through the bare half, the defining condition solves to

$$\mathfrak{y}_{\mathrm{rec}} = \ln \frac{\mathfrak{u}_{\mathrm{ox}}}{\mathfrak{u}_{\mathrm{bare}}} - \ln \frac{\mathfrak{v}_{\mathrm{ox}}}{\mathfrak{v}_{\mathrm{bare}}} + \ln \frac{1 + \mathfrak{L}_{\mathfrak{z}_{\mathrm{ox}}}}{1 + \mathfrak{L}_{\mathfrak{z}_{\mathrm{bare}}}} - 2 \ln \mathfrak{p}, \tag{19}$$

and with each half's forward and inverse factors equal and the heat fluxes equal, $\mathfrak{y}_{\mathrm{rec}} = \ln[(1 + \mathfrak{L}_{\mathfrak{z}_{\mathrm{ox}}})/(1 + \mathfrak{L}_{\mathfrak{z}_{\mathrm{bare}}})]$, which lies between $\ln[(1 + \mathfrak{L}\tanh(\mathfrak{d}_{\mathrm{Pt}}/\mathfrak{l}_{\mathrm{sd}}))/(1 + \mathfrak{L}\coth(\mathfrak{d}_{\mathrm{Pt}}/\mathfrak{l}_{\mathrm{sd}}))]$ and zero; recomputed from the source's values (SC-160 to SC-163, L222–L224, right), that lower end is -0.03 at the one figure of $\mathfrak{g}_{\mathrm{r}}$, inside the interval. The twelve come from deposition runs whose Pt-only slab, from loading inputs measured before any reading (external), gives that lower end inside the interval. On the source's model as printed — the bracket of Eq. (4) with the detection factor of Pt alone, under "similar assumptions" (SC-183, L288–L289, left) — and with the heat fluxes equal, $\mathfrak{E}_{\mathrm{inv}} = 1$ and $\mathfrak{y}_{\mathrm{rec}}$ is the logarithm of the source's electrical enhancement (SA-57), also recomputed: $\ln(2.8 \pm 0.5) = 1.0 \pm 0.2$. Each channel and its sign are in the table below.

channel	sign it gives $\mathfrak{y}_{\mathrm{rec}}$
the difference of the two settlements	one sign in every slab, its sense unassigned; the test is two-sided
the change of the loading	one sign in every slab; its sum with the next row inside the interval from $-\mathfrak{c}_{\mathrm{rec}}$ to $+\mathfrak{c}_{\mathrm{rec}}$
twice the logarithm of the two halves' heat-flux quotient	either sign; held by the measured surface temperature of each half (external)
the gradient along the slab; the drift	signs the deposition coin and the reading-order coin set

Statistic, decision rules and ablation. The statistic is the twelve values, with a two-sided sign-flip permutation test over all 4096 flips, the bound $\mathfrak{b} = \mathfrak{c}_{\mathrm{rec}}$ and the scale $\mathfrak{h} = \mathfrak{h}_{\mathrm{rec}} = 0.2$ (U-20, investigator-chosen). Detection — the bounded test; exclusion — the exclusion test; inconclusive otherwise; attribution — a detection is read as the difference of the two settlements when it stands with the interval recomputed from the slabs' measured loading inputs and surface temperatures (external). Ablation test point: with the bound at its ceiling, $\mathfrak{c}_{\mathrm{rec}} = 0.05$ (U-19), the values are $\mathfrak{h}_{\mathrm{rec}} = 0.2$ against zero, the bounded test's shifted values $\mathfrak{h} - \mathfrak{b} = 0.15$, and the threshold $\mathfrak{b} + 5(\mathfrak{h} - \mathfrak{b})/6 = 0.175$; the difference of 0.2 exceeds it, so the decision rule separates the FDT input from its ablation.

6 Cross-domain

The three inputs read beyond this stack, and no reading below is counted with T-1 to T-5. The pair of twist designs of T-1 and T-2 transfers to any coated element, on a magnetic insulator or a non-magnetic substrate, whose taper and single coated face leave an axial part odd in the hand (P-5). The isotope comparison of T-3 holds for an oxide formed in ^{18}O against ^{16}O on any light metal the source names, Ti among them (SC-032, L52–L53, right), its consensus channels bounded as there (I-7). In this analysis's reading of 0.1a, the two settlements read wherever a conversion and its inverse are measured on one sample, quotiented half against half as in T-5.

7 System-level reading (exploratory)

This section is exploratory: its one observable re-describes the source's own numbers in-sample; it is not a prediction and is not counted with T-1 to T-5.

7.1 X-1: the two angles of CuO_x beside the antisymmetric part

Observable. The quotient $\Theta_{\mathrm{ON}}/\Theta_{\mathrm{OH}}$ of the source's two effective angles of CuO_x, $+22.5 \pm 6.8\,\%$ (SC-140, L272, left) and $+11.8 \pm 3.6\,\%$ (SC-190, L314–L315, left).

Defining condition. In this analysis's reading (I-3a), both angles measure, per unit drive, one antisymmetric part of the deviation map of the oxidized layer's conduction electrons, under the clock-factor gradient for Θ_{ON} and under the charge drive for Θ_{OH}, so their quotient re-describes how that part loads in the medium window against the charge drive; on the source's numbers it is 1.9 ± 0.8, in quadrature, the two angles sharing their positive sign.

Comparator. The source's own reading: two effects of "an effective single layer", with no relation imposed between them (SC-144, L280–L281, left; SC-196, L292–L293, right; SA-49, SA-63).

Guards. The reading assigns the antisymmetric part no magnitude and no sign and declares no kernel, so the quotient carries no FDT number: it is this analysis's arithmetic on the source's numbers, in-sample, resting on assumptions (i) to (iii), on the "similar assumptions" of the orbital Hall angle (SC-183, L288–L289, left) and on the effective-single-layer limitation, and it predicts nothing; the 5-nm values do not enter it, no input of their effective ratios being printed.

8 Convergence statement

The limiting map by which this analysis recovers the consensus data is the identity map of Use item 2: on the source's own inputs and dictionary FDT returns, for its samples with 3 nm of Pt, its quotients, estimates, four angles and four conductivities, set beside the source's values in the observation map; each step corroborates no invariant. FDT agrees with the data of general relativity and quantum mechanics on this record without reservation: every contrast, ratio, sheet resistance and Seebeck coefficient the source reports is accepted in full. Two readings of the standard account are declined, once each. The standard account reads the applied field that the source sweeps to align the YIG magnetization (SC-091, L160–L161, left; SA-28) as an entity of its own, distinct from the material it acts on. FDT reads it as a helical density gradient of the omnium (P-5); the field values and the alignment are accepted as printed. The standard account reads the source's single spin Hall angle, squared in the SMR fit (SC-165, L238–L239, right; SA-54), as one matrix element for the conversion of a charge current into a spin current and for the conversion back. FDT reads the two directions as a process and its run backward, two system-wide settlements each from its own starting state (0.1a); the measured ratio and the fitted angle are accepted in full and returned by the identity map. FDT makes a divergence claim only where it supplies an additional source (P-5: T-1, T-2), a constitutive input (I-7: T-3, T-4) or a changed observable dictionary (0.1a: T-5), never from α, a chart or a branch tag alone, and each block's convergence value is its comparator's.

9 Status ledger

The table below states once every item to be derived that this analysis touches, in the core's words, the held-out targets, every prediction block with its status, the in-sample reading and the range-only tokens; the abstract's count is read off its T rows.

item	content	status
O-1	the finite-core cutoff r_c, the regular core chart, or the outward phase-transfer law	to be derived
O-2	a geometrically constructed odds for the overlap-contrast application (A-3)	to be derived
O-3	a canonical odds for the confinement application (A-4)	to be derived
O-4	the local profile $\rho_{\mathrm{loc}}(r_f)$ from the omnium constitutive law with boundary, surface and core data, reducing to the measured nuclear profile	to be derived
O-5	multipole and tidal remainders of the closed-form pair expression, and the reading they give of the band $R_H < r_f < R_s$ outside a rotating source's horizon; the overlap complex; how P-4's many-cone settlement signs a pair it does not join	to be derived
O-6	the maps from a charge, a circulating charge or a colour seat to an I-1 input; derivation of the A_2 seat table from cone geometry; the gluon octet's dynamics	to be derived
O-8	the constitutive derivation of c_{eff} / $\mathfrak{n}_{\mathrm{cone}}$ and its reconciliation with lensing	to be derived
O-9	the confinement operator D, its domains, boundary data and spectrum; every mass ratio, including the two held-out targets	to be derived
O-11	ν_F on the exact framed closures; the odd-parity absorption proof; proof that the spinorial class is nontrivial	to be derived
targets	$m_p/m_e = 1836.15267343$ and $(m_\mu/m_e)^2 = 4.2753 \times 10^4$ (U-27), held-out tests a derived operator must reproduce, never outputs (I-5)	held-out
T-1	DC-1, SA-75: a hand-odd, reciprocity-odd resistance on twisted YIG in zero applied field (P-5); convergence value zero within the ambient leak	prospective existence test
T-2	DC-2, SA-76: the same on a non-magnetic garnet (P-5); convergence value zero within the ambient leak	prospective existence test
T-3	DC-3, SA-77: an isotope shift of $\ln \mathfrak{q}_{\mathrm{th}}$, upward in this analysis's reading (I-7); convergence value the consensus shift inside $\pm\mathfrak{c}_{\mathrm{iso}}$	prospective sign test
T-4	DC-4, SA-78: an isotope shift of $\ln \mathfrak{q}_{\mathrm{el}}$, upward in this analysis's reading (I-7); convergence value the consensus shift inside $\pm\mathfrak{c}_{\mathrm{iso}}$	prospective sign test
T-5	DC-5, SA-79: a difference between the forward and the inverse enhancement (0.1a); convergence value inside $\pm\mathfrak{c}_{\mathrm{rec}}$	prospective existence test
in-sample	the quotient of the source's two angles of CuO_x in the exploratory section (I-3a, P-5)	in-sample
tokens	α_{ovl}, α_{conf}, α_{mode}: the A-3, A-4 and A-5 tokens, each a range, no value	range only

10 Conclusions

On its own inputs the source's values for its samples with 3 nm of Pt are returned by the identity map, no input of its ratios at 5 nm of Pt being printed, and FDT accepts every measurement in it. In this analysis's reading, its temperature gradient is a clock-factor gradient on the declared domain, its transverse currents are flows of the bivector grade, its applied field is a helical density gradient, its stages are system-wide settlements, and each film datum is a thickness mean with its weight named — the conductance weight of the source's parallel-resistance model for a stack's sheet resistance and Seebeck coefficient, the region of the Pt within the source's spin diffusion length of the YIG/Pt interface for the two contrasts. T-1 to T-5 state three core clauses as predictions general

relativity and quantum mechanics do not make — a twist read as a field (P-5), an oxygen-isotope shift of the Pt layer's effective ratios (I-7), and an inverse conversion unmirrored by the forward one (0.1a) — each decided by an exact sign-flip rule on twelve values, T-3 and T-4 on the sign of their shifts and T-1, T-2 and T-5 on the existence of their effects.

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