CQE Coursebook (v2) - Modules 0-12

CQE: A Coursebook (v2)

Module 0 - Orientation
Goal: Learn the CQE spine while keeping meaning provisional.
Spine: Stand-ins -> DNA-10 -> Octet Overlays -> Palindromic Mirror -> Delta-lifts -> Strict Ratchet -> Receipts -> 4-bit Commit.
Form/Meaning Split: Forms are coded geometry (Construction-A shells, E8 slices, Leech patches); meanings are swappable token packs.

Module 1 - Tokens & Stand-ins
- Token cards: quantity, unit, range/guards, provenance hash.
- Use observed glyphs (domain-native symbols) as labels; bind hashes, not prose.
- Practice: Define 8-16 tokens for any domain (sound, heat, light).

Module 2 - DNA-10 State Save
Record: timing, polarity, scale, pose, domain, conditioning, units, precision, cost, seed.
Idempotence check: replay must reproduce the same DNA-10 with <= tolerances.

Module 3 - Octet Overlays (8 Views)
Choose 8 materially independent views (modalities, bands, slices, regimes).
Example sets:
- Sound: time, freq, spectrogram, phase, envelope, impulse, spatial, nonlinearity probe.
- Heat: conduction, convection, radiation, steady-state, transient, boundary, stochastic, microstructure.
- Light/QED: polarization (L/R), linear (X/Y), near/IR/UV, coherent/incoherent.

Module 4 - Palindromic Mirror
Enforce forward o inverse ≈ identity within written tolerances. Examples:
- FFT<->iFFT (signals), encode<->decode (codes), simulate<->measure (experiments).
Record residuals and parity votes (lane A/B).

Module 5 - Delta-lifts (Local Repairs)
Small monotone edits that strictly reduce local debt and do not regress other views.
Keep a published Delta-cookbook per domain.

Module 6 - Strict Ratchet
After a clean replay, tighten thresholds (ULP error, AR, WFE, BER, DeltaT).
Never loosen; if a pass fails after tightening, rollback and log.

Module 7 - Receipts & 4-bit Commits
- OPE/FCE debt, mirror votes, view votes, hashes.
- 4-bit code is the minimal commit fingerprint; upgrade to 8/64 only on collisions.

Module 8 - Geometry: Construction-A -> E8 -> Leech
- Construction-A (binary): lattice from code + glue.
- E8 embedding appears naturally once the n=5 hinge forces an octad.
- Leech slice legality at 24; Monster/M24 act as braid/permutation to clone forms deterministically.

Module 9 - Sidecars (Mini-labs)
Define up to 64 tabs: OPTICS, THERMAL, POLAR, MATH, SOUND, HEAT, QED, SPIN, PLASMA, BIO, etc.
Each tab runs the same ritual spine independently and emits its own 4-bit.

Module 10 - Safety & Redaction
- Compute freely; publish receipts selectively.
- "Some results redacted for safety" is acceptable; bind hashes to receipts.
- Keep dangerous specifics outside public meaning packs; forms + receipts suffice for audit.

Module 11 - Runtime
- Workorder JSON -> orchestrator spins sidecars -> overlay/mirror -> Delta/strict -> commits.
- Always view with local 8x8 and surrounding 4x4x4x4 and parity 2x2x2x2 neighborhoods.

Module 12 - Capstone
Pick 1 domain; produce: token pack -> octet -> mirror logs -> Delta-cookbook -> strict ratchet -> receipts -> 4-bit.
Deliver both a public report and a private ledger (hashes + thresholds).

Lab: Light & QED

Lab: Light & QED - Octet + Mirror + Receipts

Objective: Stabilize an optical experiment (polarization + spectrum) with CQE and produce a 4-bit commit.

Token Pack (examples)
- wavelength_nm $\in$ [350, 900], power_mW, polarization $\in$ {L,R,X,Y}, coherence $\in$ {coh,incoh}, detector_SNR, grating_lpmm.

Octet Views
1) Polarization: L 2) Polarization: R 3) Linear-X 4) Linear-Y
5) Spectral narrow 6) Spectral broad 7) Coherent 8) Incoherent

Mirror
Forward: source->polarizer->spectrograph->detector
Inverse: detector model->spectral deconvolution->polarization inverse->source constraints
Tolerance: DeltaI/I <= 1.5% across bands; DoP error <= 0.02.

Delta-Cookbook (examples)
- Swap LC bias; retune analyzer angle.
- Constrain deconvolution kernel to physically plausible PSD.
- Clamp stray-light floor via dark-frame parity.

Strict Ratchet
Tighten DeltaI/I to 1.0%, DoP error to 0.015 after first pass.

Receipts
- Mirror votes: 22/24, view votes >= 6/8.
- Hashes: data, configs, thresholds.
- 4-bit: 1011 (example).

Worksheet
Fill: token cards, octet table, mirror residuals, Delta-edits, strict deltas, receipts.

Lab: Spintronics

Lab: Spintronics - Chiral Spin Filters at Room Temperature

Objective: Validate a chiral nanohelix as a spin filter using CQE.

Tokens
- helix_handedness $\in$ {L,R}, diameter_nm, pitch_nm, material, J_in (uA), B_ext (mT), T (K).

Octet
1) L-hand no B 2) R-hand no B 3) L-hand +B 4) R-hand +B
5) Low-bias 6) High-bias 7) DC 8) AC

Mirror

Encode: device->I-V-P (spin polarization)
Decode: polarization model->expected I-V under symmetry
Tolerance: |P_meas − P_model| <= 0.05 absolute.

Delta-Cookbook
- Repaint bias gradient; reduce contact resistance asymmetry.
- Thermal pre-conditioning sweep.

Strict
Tighten polarization bound to 0.03.

Receipts
Votes + hashes, 4-bit example: 1101.

Lab: Plasma Braiding

Lab: Plasma Braiding - Parity & Chirality Mapping

Objective: Detect braided flux structures and chirality flips in MHD data using CQE.

Tokens
- B_field map(t,x,y,z), v_plasma, resistivity, probe cadence, domain masks.

Octet
1) Left-hand braid 2) Right-hand braid 3) Null sheet 4) Reconnection zone
5) Low-beta 6) High-beta 7) Quiescent 8) Burst

Mirror
Forward MHD step vs. inverse constrained step; helicity conservation within ε.
Tolerance: helicity error <= 2%, Poincaré map fixed-point stability.

Delta-Cookbook
- Local resistivity floor; adaptive timestep around current sheets.
- Flux-surface relabeling to remove gauge drift.

Strict
Helicity error -> 1% after first pass.

Receipts
Votes + hashes, 4-bit example: 1010.