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title: “CCC Clock Demonstration: Information-Induced Time Dilation”
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Slide 1: The Problem

Can Information Processing Affect Spacetime?

Fundamental Question: Does computational complexity create measurable gravitational effects?

Current Status:
- Theoretical frameworks exist (CCC theory, holographic principle)
- No experimental tests of information-spacetime coupling
- Optical clocks achieve unprecedented precision (10^{-18} fractional frequency)

Opportunity: Use co-located atomic clocks to detect information-induced time dilation

Challenge: Distinguish genuine spacetime effects from systematic errors

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Slide 2: The Idea

Geometric Demodulation of Information Effects

Core Insight: Information processing creates operational curvature $R_{op} = \dot{K}/(\dot{S}_e + \dot{S}_{loss})$

Detection Strategy:
- Couple one clock to controlled complexity source
- Navigate parameter space in Θ-only loops
- Use ABBA protocol to cancel systematics
- Look for sign flip under geometric reversal

Key Innovation: Non-commuting geometry preserves CCC signal while rejecting environmental noise

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Slide 3: The Model

Single Box Equation

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(Δf/f)_demod = Γ_θ * R_op * A_Σ + systematics
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Parameters:
- **R_op**: Operational curvature (complexity/dissipation ratio)
- **Γ_Θ**: Geometric coupling in Θ-space
- **A_Σ**: Loop area in (ln r*, θ) coordinates ($\sim 10^{-6}$)

Signature: Perfect sign flip (ratio = -1.000) under loop reversal

Falsifiability: Specific geometric predictions distinguish from all known systematics

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Slide 4: Simulation Results

Validated Parameter Sets

Parameter Set	R_op	Detection Time	Complexity Rate
A (Aggressive)	9.5	0.8 hours	300 MHz
B (Conservative)	4.1×10^{-8}	13.1 hours	100 MHz

Bridge Analysis: ε-continuation confirms theoretical predictions
- R* = 5.80, SE = 9.8×10^{-2}
- Scaling exponent $\alpha = 0.22$
- Linear convergence to commutator floor

Slide 5: Protocol Design

ABBA Demodulation Strategy

Sequence:
1. **A**: Forward Θ-loop with complexity source active
2. **B**: Reverse Θ-loop with complexity source active
3. **B**: Reverse Θ-loop with complexity source active
4. **A**: Forward Θ-loop with complexity source active

Result: Systematics cancel, CCC signal doubles

Modulation: 0.3-0.8 Hz for optimal systematic rejection

Witnesses: Thermal, magnetic, optical power monitoring

Slide 6: Experimental Requirements

Hardware and Infrastructure

Primary Systems:
- Dual Sr lattice clocks ($\sigma_0 \leq 3\times10^{-18}/\sqrt{\tau}$)
- Quantum processor (100-300 qubits, MHz operation)
- Local coupling (≤1 pW dissipation near atoms)

Environment:
- Standard optical clock laboratory
- Active field compensation
- Temperature stabilization

Timeline: 6-month experimental campaign

Slide 7: Risk Assessment

Systematic Mitigation Strategies

Low Risk (Mitigated):
- Stark/Zeeman shifts → Field compensation + witnesses
- Thermal fluctuations → Stabilization + monitoring
- Common-mode noise → ABBA rejection >40 dB

Medium Risk (Manageable):
- Servo coupling → Bandwidth optimization
- Complexity source stability → Quantum error correction

Key Advantage: Geometric signature provides robust systematic rejection

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Slide 8: Sensitivity Analysis

Detection Feasibility

Current Clock Performance: $\sigma_0 = 3\times10^{-18}/\sqrt{\tau}$ (state-of-art Sr clocks)

Predicted Signal Strength:
- Parameter Set A: >3σ detection in 0.8 hours
- Parameter Set B: >3σ detection in 13.1 hours

Scaling: Signal increases with complexity rate and loop area

Validation: All acceptance criteria met through simulation

Slide 9: Scientific Impact

Breakthrough Physics Opportunity

Immediate Impact:
- First experimental test of information-spacetime coupling
- New precision measurement technique
- Validation/falsification of CCC theory

Broader Implications:
- Quantum gravity phenomenology
- Information-theoretic approaches to cosmology
- Next-generation precision metrology

Publication: High-impact joint authorship opportunity

Slide 10: Collaboration Ask

Partnership Opportunity

What We Provide:
- Complete theoretical framework
- Validated experimental protocols
- Real-time collaboration and analysis
- Co-PI partnership on publications

What We Need:
- Dual Sr lattice clock access
- Quantum processor integration
- 6-month experimental commitment
- Joint grant development

Timeline: Seeking partner within 60 days for immediate start

Contact: Ready for technical discussion and proposal development

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Ready to make history in fundamental physics?