

LFM Phase1 Test Design

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Standard Introduction

This document is part of the Lattice-Field Medium (LFM) Phase 1 publication set. It follows our standard formatting and reproducibility guidelines.

Lattice-Field Medium (LFM): Phase 1 Test Design — Proof-of-Concept Validation System

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Abstract

Phase 1 defines the design and implementation framework for validating the Lattice-Field Medium (LFM) through reproducible Tier 1–5 tests. It specifies the environment, configuration architecture, pass/fail criteria, and proof-packet generation protocol required to establish numerical and physical correctness of the model including complete electromagnetic theory validation. This version modernizes the document layout for reproducibility and OSF publication compliance.

1 Purpose

Phase 1 establishes the full architecture for the LFM Proof-of-Concept Validation System. The goal is to provide a reproducible testing environment that demonstrates Tier 1–5 correctness and creates a foundation for expert review.

2 Hardware and Environment

Component	Specification	Notes
System	MSI Katana A15 AI	Primary development
node		
CPU / GPU	Ryzen 7 8845HS / RTX 4060 (8 GB VRAM)	Hardware sufficient for all Tier 1–5 test cam paigns

RAM / Storage	32 GB / 1 TB SSD	Sufficient for 3D Tier
	3 tests	
OS	Windows 11 x64	
Python Environment	3.11.9 + NumPy, SciPy,	Standard computation Numba, CuPy-CUDA12x stack
Version Control	Git (local → GitHub)	Ensures provenance and private) reproducibility

3 Folder and File Architecture

The LFM Proof-of-Concept environment follows a strict folder structure: LFM— Source modules and Tier kernels LFM— JSON configuration and thresholds LFM— Runtime data for each experiment LFM— Metrics, plots, and summaries LFM— Execution and environment logs LFM— Proof-packet archives

4 Configuration and Validation Logic

Global tolerances reside in `/config/validation_thresholds.json`, with Tier-specific overrides in `/config/tierN_default.json`. Merge order: global → local → runtime. Configuration keys include tier, parameters, tolerances, run_settings, and notes.

5 Pass/Fail Framework

Tier	Goal	Pass Criteria (Phase 1)
1	Lorentz isotropy & energy drift within typical dispersion	$\Delta v/c \leq 1\%$, anisotropy $\leq 1\%$; bounds $10^{-6} \dots 10^{-4}$ depending on grid/BCs
2	Weak-field / redshift	Correlation > 0.95 with analytic model; drift $\leq 1\%$
3	Energy conservation $ E_0 $ within $10^{-6} \dots 10^{-4}$ typical; figured as 1×10^{-12} in json for conservative runs	Relative energy drift $ \Delta E /$ strict baseline tolerance configured in <code>/config/validation_thresholds.json</code> .
4	Quantum behavior with <2% error; quantum tunneling	Discrete energy eigenvalues w

5	Electromagnetic theory validation; Coulomb's law $\phi = kq/r$	Complete Maxwell equation validation; wave speed $c = 1/\sqrt{\mu_0 \epsilon_0}$ confirmed;	demonstrated; uncertainty relation $\Delta x \cdot \Delta k \geq 0.5$ confirmed
			within $\pm 0.1\%$; electromagnetic 21/21 (100%) test success rate on implemented electromagnetic phenomena

6 Orchestration and Parallelism

The master script `run_all_tiers.py` references `/config/orchestration.json` to schedule tiers and variants with a concurrency limit (default 3). Each run executes `run_tier.py`, writes results, and aggregates metrics into `/results//summary_overall.json`.

7 Visualization and Reporting

Plots auto-generate under `/results///plots/`. Each follows scientific styling standards (`energy_vs_time`, `anisotropy_vs_time`, etc.). A summary dashboard (`summary_dashboard.html`) compiles all Tier results.

8 Expert Review Packaging Workflow

After all Tier tests complete, the system assembles a proof packet in `/packages/LFM_ProofPacket_vX.Y.zip`. Each archive contains README, manifest, environment info, configs, code snapshot, results, logs, and SHA-256 hashes. Integrity checks and optional Cardano anchoring ensure reproducibility.

9 Phase 1 Test Scope

Phase 1 currently executes Tier 1–5 tests. Canonical expected counts are tracked in the results registry; refer to the results rollups for authoritative counts. Additional exploratory tests may be present. Refer to the per-tier results under `results/*` for PASS/FAIL/SKIP status. Expected duration for a full run depends on hardware and concurrency.

10 Data Reproducibility and Licensing

All code and data products are released under CC BY-NC-ND 4.0 (non-commercial, attribution required; no derivatives). Each result file includes environment hashes and deterministic seeds. Reproducibility requires the same configuration files and random seed identifiers as recorded in the proof packets.

11 Metadata Alignment

Field	Value
Keywords	lattice field theory; discrete

time; emergent relativity;	space
ducibility; computational	repro
cs	physi
License	License CC BY-NC-ND 4.0
commercial, attribution	(non-
red)	requi
Category Tags	Theoretical Physics · Computational
cs · Simulation Frameworks	Physi
Data Availability	All proof packets and logs provided
pplemental data under	as su
ducible archive.	repro
Funding / Acknowledgements	Self-funded; no external sponsors.
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12 Summary

Phase 1 provides the reproducibility framework for all Tier 1–5 LFM tests. It defines configuration structure, orchestration logic, validation thresholds, and proof-packet packaging. Successful completion confirms the model’s stability, isotropy, conservation, quantum behavior, and electromagnetic theory reproduction—forming a complete empirical foundation for this phase.

13 Legal & Licensing Notice

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Defensive Publication Statement This publication constitutes a defensive disclosure establishing prior art as of October 29 2025 for all concepts, algorithms, and methods described herein. Its release prevents any later exclusive patent claim over identical or equivalent formulations of the LFM validation architecture.

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