Bruno Luçardo Olivaes

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Research Summary

Independent computational physicist and research engineer investigating the foundations of scale-invariance in physical systems, observational cosmology, quantum error mitigation, unbinned likelihood inference at particle colliders, and post-quantum network security. Author of **The Matrioska Protocol**, a statistical architecture enforcing 5-gate anti-hallucination standards across heterogeneous experimental datasets.

Unified Master Monograph

The Matrioska Protocol: From Primordial Discrete Scale Invariance to Post-Quantum Agility
Monograph Synthesis (45 pages, 7 Chapters), November 2026. CDD: 500 → 530.1.
Permanent Open-Access Archive (Zenodo): doi:10.5281/zenodo.24124702.

Scientific Publications & Preprints

1. **Breaking the Binning Attenuation Barrier: Unbinned Composite Quadrature Likelihood and Neural Simulation-Based Inference for Certified DSI Searches at the LHC**
   B. L. Olivaes (2026). CDD: 006.3 / 539.7.
   Preprint / In Preparation for PRD. Permanent Zenodo Archive: doi:10.5281/zenodo.24149842. GitHub: bruno-olivaes/lhc-nsbi-dsi (v1.0.1).

2. **A Certified Search for Discrete Scale Invariance in LHC Dimuon Mass Spectra**
   B. L. Olivaes (2026). CDD: 539.7 / 006.3. CMS Open Data ($\sqrt{s} = 7\,\text{TeV}$, $N = 62,214$).
   Permanent Zenodo Archive: doi:10.5281/zenodo.24149840. GitHub: bruno-olivaes/lhc-dsi-search (v1.0.1).

3. **Constraints on Primordial Discrete Scale Invariance from the Planck 2018 Temperature Power Spectrum**
   B. L. Olivaes (2026). CDD: 523.1 / 530.1.
   Preprint / In Preparation for MNRAS. Pre-registered Protocol (v2.1.2).
   Permanent Zenodo Archive: doi:10.5281/zenodo.24121677. GitHub: bruno-olivaes/dsi-cosmo-search.

4. **Spectral Analysis of Systematic Residuals in Casimir Force Measurements: Lossless Vector Re-Audit, Statistical Pitfalls, and KPFM Patch-Potential Metrology**
   B. L. Olivaes (2026). CDD: 530.4 / 620.5.
   Preprint / In Preparation for RSI.
   Permanent Zenodo Archive: doi:10.5281/zenodo.24121687. GitHub: bruno-olivaes/casimir-afm-spectroscopy.

5. **When Harmonic ZNE Fails: A Comparative Benchmark of Error Mitigation on NISQ Devices**
   B. L. Olivaes (2026). CDD: 006.3 / 530.1.
   Preprint / In Preparation for QST.
   Permanent Zenodo Archive: doi:10.5281/zenodo.24121693. GitHub: bruno-olivaes/qiskit-lombscargle-zne.

6. **Testing Log-Oscillatory Dark Energy with Pantheon+, DESI BAO, and Stage-IV Euclid Forecasts: Non-Linear Degeneracy and Fisher Matrix Limits**
   B. L. Olivaes (2026). CDD: 523.1. Joint Pantheon+ (1580×1580 cov), DESI BAO, and Planck CMB.
   Permanent Zenodo Archive: doi:10.5281/zenodo.24121691. GitHub: bruno-olivaes/oscillatory-dark-energy-euclid.

7. **The Network Cost of Post-Quantum Cryptography: TCP Fragmentation in TLS 1.3 Handshakes**
   B. L. Olivaes (2026). CDD: 005.8 / 006.3. Benchmarking NIST FIPS 203 (ML-KEM-768) wire overhead.
   Permanent Zenodo Archive: doi:10.5281/zenodo.24121695. GitHub: bruno-olivaes/pqc-crypto-agility-benchmark.

Technical Competencies & Software Architecture

- **Scientific Programming & Data Analysis:** Python 3.12+, NumPy, SciPy (optimize, signal), Astropy (LombScargle), Matplotlib, Pandas, HDF5/h5py, PyMuPDF vector extraction.
- **Statistical Inference & Likelihood Modeling:** Unbinned continuous profile likelihood estimation, numerical quadrature, profile likelihood ratio ($q(\varepsilon)$), MCMC ensemble sampling (`emcee`).
- **Quantum Computing Simulation:** Qiskit 2.x, Qiskit Runtime Primitives, transmon noise modeling (`AerSimulator`), Zero-Noise Extrapolation (ZNE), Pauli Twirling / Randomized Compiling.
- **Post-Quantum Cryptography Analysis:** NIST FIPS 203 (ML-KEM/Kyber), TLS 1.3 handshake wire cost, TCP segmentation modeling over standard MTU (1500 B).
- **Rigorous Metrology & Open Science:** Pre-registered protocols (v2.1.2), 5-Gate Integrity Protocol, look-elsewhere correction via phase-scrambled bootstrap ($B = 1000$), Dewey Decimal Classification (DDC) taxonomies, Zenodo integration, Git/GitHub, LaTeX.