Ultra-High-Vacuum Null Tests of Electrostatic Projection Couplings with Symmetry-Matched Capacitors

Experimental Protocol for Scalar, Boundary-Flux, and Artifact-Separation Searches

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June 6, 2026

Abstract. This paper specifies a falsification-first experimental program for electrostatic residuals suggested by five-dimensional Maxwell-compatible projection models. The target is not a free-space propulsion demonstration. The target is an auditable measurement protocol that separates electrohydrodynamic thrust, leakage forces, thermal drift, cable coupling, dielectric creep, Maxwell stress, scalar-energy residuals, and boundary-flux residuals. A symmetry-matched capacitor family is proposed, including symmetric plates, edge-enhanced asymmetric devices, leakage dummies, grounded-shield controls, and mass-balanced inversions. Each device is tested across pressure, polarity, orientation, shielding, and frequency-modulated drive conditions on horizontal, vertical, and torsional balances. The expected result is a bound on coupling families; a positive residual is treated as a candidate systematic until it survives the entire null matrix.

Working-paper status. This manuscript is speculative and methodological. It makes no claim of experimentally demonstrated exotic propulsion, room-temperature superconductivity, inertial-mass reduction, or gravitational-wave generation. Its purpose is to state assumptions, formalize hypotheses, and define tests whose null outcomes are scientifically useful.

Contents

1 Problem

Electrostatic anomaly claims often fail because they measure one number - a net displacement or force - while leaving too many conventional mechanisms unconstrained. This is especially problematic for asymmetric capacitors, where atmospheric electrohydrodynamic effects, corona discharge, leakage, heating, and wiring forces can all mimic thrust. The JMP0X1B papers on electrostatic projection coupling, boundary flux, and weak-field radion electrogravity treat this problem correctly: they require force budgets, null observables, voltage parity tests, and Maxwell-limit recovery rather than a single dramatic demonstration [1, 2, 3].

Recent high-resolution work by Tajmar, Kossling, and Neunzig searched for steady-field gravity-electromagnetism coupling under high-vacuum conditions and reported no anomalous forces or torques down to the nano-Newton and nano-Newton-meter range [4]. That result does not logically exclude every possible scalar or boundary operator, but it sets the standard: future claims must be cleaner, more discriminating, and more quantitative.

2 Experimental model

The measured force is modeled as

$$\mathbf{F}_{\text{meas}} = \mathbf{F}_{\text{EHD}} + \mathbf{F}_{\text{leak}} + \mathbf{F}_{\text{thermal}} + \mathbf{F}_{\text{cable}} + \mathbf{F}_{\text{Maxwell}} + \mathbf{F}_s + \mathbf{F}_b + \boldsymbol{\eta}. \tag{1}$$

Here $\mathbf{F}_s$ is a scalar-energy residual of the kind motivated in weak-field radion toy models, while $\mathbf{F}_b$ is a boundary-flux residual localized near edges, curvature, or mixed-normal flux. The noise and drift term is $\boldsymbol{\eta}$.

A useful experiment does not merely reduce $\boldsymbol{\eta}$. It gives each term a different transformation law. We therefore define the following ratios:

$$R_P = \frac{F(P_{\text{high}})}{F(P_{\text{low}})}, \qquad R_\pm = \frac{F(+V) + F(-V)}{F(+V) - F(-V)}, \tag{2}$$

$$R_I = \frac{F(\mathcal{G}) + F(\mathcal{IG})}{F(\mathcal{G}) - F(\mathcal{IG})}, \qquad R_S = \frac{F(\text{shielded})}{F(\text{unshielded})}. \tag{3}$$

Atmospheric EHD should collapse strongly with pressure. Leakage and corona should track current and gas composition. A scalar-energy residual should be largely voltage-even because the source is proportional to field energy density E^2. A boundary-flux residual should be edge-sensitive and inversion-sensitive.

3 Device family

Device	Purpose	Expected discriminant
Symmetric plate capacitor	baseline Maxwell-stress and thermal calibration	nearly zero external net force under inversion
Edge-enhanced asymmetric capacitor	boundary-flux sensitivity	response grows with edge functional, not merely capacitance
Leakage dummy	conventional artifact injection	force tracks current and humidity

Corona control	EHD calibration in gas	pressure and polarity dependence
Grounded shield device	environment coupling rejection	residual should not track external fields
Mass-balanced inversion pair	torque and support rejection	signal changes sign only if coupled to geometry, not mass offset

4 Test chamber and balances

The minimum useful apparatus contains:

- a vacuum chamber that reaches at least 10^{-6} mbar for hard-vacuum runs;
- a horizontal balance for lateral force, a vertical balance for lift-like artifacts, and a torsion balance for torque;
- remote high-voltage supplies with fiber control and battery isolation during critical runs;
- synchronized logging of voltage, current, pressure, temperature, acoustic vibration, magnetic field, humidity during gas runs, and chamber wall potential;
- a photon-thrust or electrostatic calibration actuator with traceable force scale.

5 Protocol

5.1 Phase 1: conventional map

Each capacitor is run in air, dry nitrogen, rough vacuum, high vacuum, and ultra-high vacuum if available. The first objective is not anomaly detection. It is to build an artifact atlas.

5.2 Phase 2: symmetry nulls

For each geometry $\mathcal{G}$, build an inverted geometry $\mathcal{IG}$, a mass dummy, and an electrical dummy. A candidate signal must obey a declared transformation table before it is assigned to any speculative family.

5.3 Phase 3: blind runs

The experimenter who evaluates the force time series should not know whether the active run used the edge-enhanced device, the symmetric device, or the leakage dummy. This prevents visual confirmation from shaping preprocessing choices.

5.4 Phase 4: coefficient extraction

If no residual survives, report bounds. If a residual survives, fit all conventional models first, then fit scalar and boundary operators only on the remaining residual.

6 Acceptance criteria

A residual cannot be called "projection coupling" unless it passes all criteria below:

1. It survives high-vacuum pressure reduction without tracking EHD controls.
2. It has repeatable voltage parity consistent with the claimed source term.
3. It survives cable rerouting, battery operation, and shield potential reversal.
4. It appears in geometry pairs with the predicted inversion or edge scaling.
5. It is larger than thermal, leakage, vibration, and Maxwell-stress uncertainties by a pre-registered margin.
6. It is independently reproduced on a second balance or at a second laboratory.

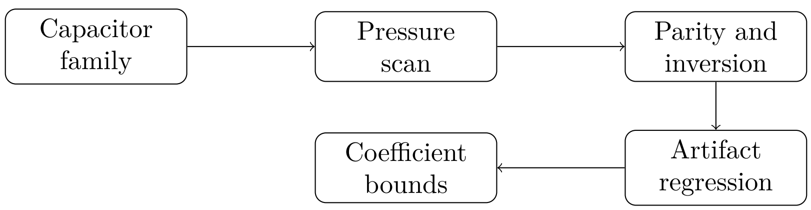

Figure 1: Falsification-first flow for electrostatic projection-coupling experiments.

7 Expected outcomes

The most likely outcome is a null result that tightens bounds on scalar-energy and boundary-flux couplings. That is a successful paper. A less likely but scientifically valuable outcome is a small residual that survives the null matrix and motivates replication. The least acceptable outcome is a large force claim without a pressure scan, inversion pair, leakage dummy, and calibrated force budget.

8 Release notes

The release should include raw time series, calibration records, geometry files, FEM meshes, pre-registration sheets, and a table of excluded coupling coefficients.

References

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