Speculative Gravity Control

A Field-Theory Candidate

31 October 2026

Classical calculation, not a discovery or an experimentally supported theory.

What this attempts

Construct a hypothetical theory in which a specified, finite-energy source can have a repulsive scalar interaction with ordinary matter. Derive its scalar charge and a gravitational-lift condition. The source should follow from field equations rather than an imposed potential chosen to cancel gravity.

The result is a four-dimensional effective-theory candidate for the gravitational-lift part of Professor Brand's problem. It does not solve the film's black-hole quantum-data problem, quantum gravity, or the full five-dimensional blackboard action. A consistent five-dimensional embedding is not constructed here. The scalar can be interpreted as a candidate light bulk mode, but that interpretation is an additional assumption.

The construction combines known monopole/dyon mathematics with hypothetical dark-sector parameters and couplings. No claim of a new monopole solution or new research result is made.

1. Specify an action

Use metric signature $(-,+,+,+)$, natural units $c = \hbar = 1$ until SI quantities are stated, and $M_*^2 = (8\pi G_*)^{-1}$. Let q be dimensionless.

$$S = \int d^4x\sqrt{-g}\,\mathcal{L} + S_o[e^{2\beta q}g_{\mu\nu}, \psi_o],$$

$$\mathcal{L} = \frac{M_*^2}{2}R - \frac{M_*^2}{2}(\nabla q)^2 - \frac{1}{4}e^{-2\Gamma q}F^a_{\mu\nu}F^{a\mu\nu} - \frac{1}{2}(D_\mu H)^a(D^\mu H)^a.$$

Here F is a hypothetical dark SU(2) gauge field, H is an adjoint Higgs field, and ordinary matter sees the metric $e^{2\beta q}g$. The dark gauge coupling is g_D. Work in the Prasad-Sommerfield limit: the Higgs potential vanishes and $|H| \to v$ at infinity. The scalar potential also vanishes. These choices are classical parameter assumptions; radiative stability is not established.

The scalar, gauge, and Higgs kinetic terms have their conventional energy signs. The gauge kinetic coefficient $e^{-2\Gamma q}$ is positive. There is no negative-mass term or wrong-sign scalar kinetic term.

The coupled equations include

$$M_*^2 G_{\mu\nu} = T_{\mu\nu}^{(q)} + T_{\mu\nu}^{(F)} + T_{\mu\nu}^{(H)} + T_{\mu\nu}^{(o)},$$

$$M_*^2 \Box q = -\frac{\Gamma}{2} e^{-2\Gamma q} F_{\mu\nu}^a F^{a\mu\nu} - \beta T_o,$$

$$D_\mu (e^{-2\Gamma q} F^{a\mu\nu}) = g_D \epsilon^{abc} H^b (D^\nu H)^c,$$
$$D_\mu D^\mu H^a = 0.$$

For ordinary nonrelativistic matter $T_o \simeq -\rho$. A purely magnetic dark configuration has $F^2 = 2B^2$. Thus the two sectors enter the scalar equation with opposite signs. The sign difference follows from specified interaction terms.

2. Give the source a regular core

The dark gauge-Higgs sector has the standard unit-charge monopole as its weak-scalar-coupling starting point. Write

$$x = g_D v r = r/R_0, \quad R_0 = (g_D v)^{-1},$$

$$H^a = v h(x) \hat{r}^a, \qquad A_i^a = \epsilon_{aij} \hat{r}^j \frac{1 - w(x)}{g_D r}.$$

The leading profiles are

$$w(x) = \frac{x}{\sinh x}, \qquad h(x) = \coth x - \frac{1}{x}.$$

They obey $w' = -wh$ and $h' = (1 - w^2)/x^2$. Near the origin $w = 1 - x^2/6 + \cdots$, $h = x/3 + \cdots$, so the physical fields and energy are regular. The mass is

$$M_0 = \frac{4\pi v}{g_D}.$$

This finite core is important: the source is not a prescribed singular $1/r$ potential. Monopoles and their electrically charged generalizations are established mathematical solutions in the specified class of hypothetical gauge theories [1,2].

3. Solve the scalar and weak metric sourced by the core

Define $\alpha =$
$(\Gamma v/M_*)$. For $\alpha \ll 1$, start with the profiles above and solve for q at leading nonzero order. The scalar equation is

$$\nabla^2 q = -\frac{\Gamma}{M_*^2} B_i^a B_i^a.$$

The monopole satisfies $B_i^a = (D_iH)^a$ and $D_iD_iH = 0$, up to orientation conventions. Therefore $\nabla^2(H^aH^a) = 2B^2$. With $q(\infty) = 0$, the regular solution is

$$\boxed{q_D(r) = \frac{\Gamma v^2}{2M_*^2}[1 - h(r/R_0)^2].}$$

At the origin q_D is finite. Far from the core,

$$q_D(r) = \frac{\Gamma v}{g_D M_*^2 r} + O(r^{-2}) = \frac{2\Gamma G_* M_0}{c^2 r} + O(r^{-2})$$

when c is restored. Its amplitude is determined by the source mass and couplings.

At leading order the BPS gauge and Higgs spatial stresses cancel. The weak Newtonian metric sourced by their energy has

$$\Phi_D(r) = -\frac{G_* M_0}{2R_0}[1 - h(r/R_0)^2].$$

Hence $q_D = -2\Gamma\Phi_D/c^2$ at this order. Scalar and gauge-profile backreaction enter at order α^2; ordinary metric self-gravity is controlled by $G_* M_0/(R_0c^2)$.

An ordinary test body has potential $\Phi_D + \beta c^2 q_D$. At large r this gives

$$\boxed{V_{oD}(r) = -\frac{G_* m_o M_D}{r}(1 - 2\beta\Gamma).}$$

The interaction is repulsive when $2\beta\Gamma > 1$. Both rest masses remain positive. This is a force between sectors with different scalar responses, not a reversal of Newton's constant for all matter.

4. The scalar charge can depend on electric charge

For a source at approximately constant ambient q, canonical normalization makes the dark gauge coupling $g_{\text{eff}} = g_D e^{\Gamma q}$. A BPS dyon with fixed magnetic and electric charge numbers has, to leading order in scalar backreaction,

$$M_D(q, \zeta) = M_0\sqrt{e^{-2\Gamma q} + \zeta^2 e^{2\Gamma q}},$$

where ζ is the electric-to-magnetic charge ratio at $q = 0$. Its dimensionless scalar coupling is the mass derivative

$$\alpha_D = \frac{\partial \ln M_D}{\partial q} = \Gamma\frac{\zeta^2 e^{2\Gamma q} - e^{-2\Gamma q}}{\zeta^2 e^{2\Gamma q} + e^{-2\Gamma q}}.$$

At $q = 0$, a purely magnetic source has $\alpha_D = -\Gamma$; equal electric and magnetic charge magnitudes give $\alpha_D = 0$; electric dominance gives positive α_D. The derivative $d\alpha_D/dq = 2\Gamma^2\,\mathrm{sech}^2(\ln\zeta + 2\Gamma q)$ is nonnegative. This is a local mass-curvature check, not a proof of full dynamical stability.

The corresponding dyon core is also regular. If $\tan\theta = \zeta$, its leading profiles use $x = g_D v \cos\theta\, r$ and $A_0^a = v \sin\theta\, h(x)\hat{r}^a$. Since $B = \cos\theta\, DH$ and $E = \sin\theta\, DH$, its leading scalar profile is

$$q_D = \frac{\Gamma v^2 \cos(2\theta)}{2M_*^2}(1 - h^2).$$

For equal electric and magnetic magnitudes, F^2 vanishes in the background and this additional scalar profile vanishes. Charging changes the source rather than selecting an arbitrary exterior integration constant.

Changing ζ requires transferring actual dark electric charge and energy. The formulas below compare externally prepared charge states. An isolated onboard controller must include its countercharge reservoir, field energy, and mass derivatives; these cannot be omitted from the body's total scalar charge.

5. A lift condition for a bound payload

Ordinary bodies source $q_E = -2\beta G_* M_E/(c^2 r)$, while their measured mutual gravitational constant is $G_N = G_*(1+2\beta^2)$. For any small, weakly self-gravitating body with mass $M_C(q)$, define $\alpha_C = d\ln M_C/dq$. Its radial acceleration outside Earth is

$$\boxed{a_r = -\frac{G_N M_E}{r^2}\frac{1 + 2\beta\alpha_C}{1 + 2\beta^2}.}$$

It rises when $\alpha_C < -1/(2\beta)$.

For an idealized bound body containing ordinary payload mass M_o and a dark source, neglecting small binding-energy corrections,

$$M_C = M_o e^{\beta q} + M_D(q, \zeta), \qquad \alpha_C = \frac{\beta M_o + \alpha_D M_D}{M_o + M_D}$$

at the chosen ambient reference $q = 0$. For a purely magnetic source, if $f = M_D/M_C$,

$$\frac{a_r}{g} = -1 + \frac{2\beta(\beta + \Gamma)}{1 + 2\beta^2} f, \quad g = G_N M_E/r^2.$$

This collective acceleration requires binding the source to the payload. Without binding, the dark core and ordinary material follow very different trajectories. The field theory above specifies the source and its force but does not specify a trap or a microscopic portal that holds it inside an ordinary station. Therefore the composite-payload launch remains conditional on this engineering and interaction assumption. The freely moving core's repulsion is already a consequence of the stated action.

6. An explicit parameter point

Choose $\beta = 10^{-3}$ and $\Gamma = 10^{6}$. Take a magnetic core with $M_0 = 10^6\,\mathrm{kg}$ and characteristic length $R_0 = 1\,\mathrm{m}$, carried with $M_o = 9.99 \times 10^8\,\mathrm{kg}$ of ordinary payload. These imply $v \simeq 9.39 \times 10^7\,\mathrm{GeV}$ and $g_D \simeq 2.10 \times 10^{-24}$. The parameter choices are hypothetical and highly unusual.

Quantity	Value
Ordinary scalar force / tensor gravity	$2\beta^2 = 2 \times 10^{-6}$
Ordinary PPN gamma	0.9999960
$\Gamma v/M_*$	3.85×10^{-5}
Scalar self-backreaction estimate, α^2	1.49×10^{-9}
Core metric compactness $G_* M_0/(R_0 c^2)$	7.43×10^{-22}
Core rest energy $M_0 c^2$	$8.99 \times 10^{22}\,\mathrm{J}$
Indicative coupling scale M_*/Γ	$2.44 \times 10^{12}\,\mathrm{GeV}$

The chosen ordinary massless-scalar force strength is below the 1.25×10^{-5} two-sigma bound in the particular scalar-tensor analysis of reference [3]. This is one constraint check, not a complete experimental or cosmological fit. Dark-sector abundances, production, and the scalar potential require further assumptions.

The idealized prepared charge states give:

Dark electric/magnetic ratio ζ	Source mass	Radial acceleration / normal g
0, magnetic	$1.000 \times 10^6\,\mathrm{kg}$	+1.000, outward
0.638	$1.186 \times 10^6\,\mathrm{kg}$	approximately 0
1, equal charge magnitudes	$1.414 \times 10^6\,\mathrm{kg}$	approximately -1.000, inward

The source is only about 0.1% of the body's mass in the first state. Its very large scalar response makes the body-Earth force repulsive. Ordinary passengers would require roughly $2g$ of structural support near Earth's surface while the body accelerates upward at approximately $1g$. The source-payload binding force would be about $2 \times 10^{10}\,\mathrm{N}$. Neither its containment nor those structures have been designed here.

7. Numerical and analytic checks actually performed

For the magnetic core, define $\psi = \Gamma q = \alpha^2 u$ and primes as d/dx. The nonlinear flat-space radial equations solved numerically were

$$w'' = 2\alpha^2 u' w' + \frac{w(w^2-1)}{x^2} + e^{2\alpha^2 u} w h^2,$$

$$h'' = -\frac{2h'}{x} + \frac{2w^2 h}{x^2},$$

$$u'' = -\frac{2u'}{x} - \frac{2e^{-2\alpha^2 u}}{x^2}\left[w'^2 + \frac{(w^2-1)^2}{2x^2}\right].$$

Boundary conditions impose a regular origin and $w(\infty) = 0$, $h(\infty) = 1$, $q(\infty) = 0$. The independent integrated energy is

$$\frac{M}{4\pi v/g_D} = \int_0^\infty dx\, \mathcal{E}(x),$$
$$\mathcal{E}(x) = e^{-2\alpha^2 u}\left[w'^2 + \frac{(w^2-1)^2}{2x^2}\right] + \frac{x^2 h'^2}{2} + w^2 h^2 + \frac{\alpha^2 x^2 u'^2}{2}.$$

The far scalar charge was independently extracted from the asymptotic solution. A virial identity equates this scaled scalar charge and the dimensionless mass for this magnetic model [2].

At $\alpha = 3.85387 \times 10^{-5}$, the calculated dimensionless mass was 0.99999999967 and the scalar charge was 1.00000000028. Their difference was 6.2×10^{-10}. The maximum scaled-scalar difference from $u = (1-h_{\mathrm{BPS}}^2)/2$ was 1.3×10^{-10} on the numerical grid. These are numerical agreement measures, not certified rigorous error bounds.

As a check at appreciable nonlinear coupling, $\alpha = 0.05$ gave dimensionless mass 0.99963314013 and scalar charge 0.99963314034, agreeing to 2.1×10^{-10}. The maximum boundary-value-solver RMS residual was approximately 2×10^{-8} in each run. Gravitational corrections to the core are neglected at the explicitly tiny compactness given above.

The BPS profiles satisfy the first-order equations and minimize the uncoupled monopole energy at fixed topological charge. Positive kinetic coefficients, a regular static solution, and weak backreaction have been checked. A complete perturbation spectrum of the coupled Einstein-scalar-dyon system has not been calculated. In particular, static convergence and the absence of wrong-sign kinetic terms do not establish full stability. Reference [2] discusses the expected stability of the weakly coupled fundamental branch and the different status of excited branches.

8. Energy and momentum

The action is translation invariant, so Earth and source exchange momentum. The source is part of the body, rather than an immovable external field generator. There is no reactionless acceleration of an isolated system.

The weak-field Earth-body interaction energy is

$$U(r) = -\frac{G_* M_E M_C}{r}(1 + 2\beta\alpha_C).$$

For the repulsive state it is positive and falls as the separation increases. The launch kinetic energy comes from this interaction energy. Loading, assembling, or charging the source near Earth must account for that energy. For a body whose outward acceleration is approximately normal g, the surface-to-infinity interaction-energy change is approximately $G_N M_E M_C/R_E$: about 6.3×10^{16} J for $M_C = 10^9$ kg.

Charging the example core from the purely magnetic state to equal electric and magnetic magnitudes increases its isolated mass by $(\sqrt{2}-1)M_0$, requiring about 3.72×10^{22} J from an external charger before additional losses and environmental interaction-energy changes. This large change is included in the prepared-state masses in the table. No inexpensive power supply is implied.

9. What has and has not been repaired

Repaired: the repulsive field has a specified matter source, a regular finite core, a scalar charge derived from an action, a solved weak-field branch, an explicitly charge-dependent force law, and consistent leading-order energy and momentum accounting. Its amplitude is not chosen independently to force cancellation.

Still open: whether the assumed dark sector exists; how to produce, contain, bind, and charge the source; the full coupled stability spectrum; quantum corrections and the tuning of the light scalar; a full experimental and cosmological fit; and a genuine five-dimensional completion of Brand's setup. The bound payload example is a conditional consequence, not a completed station design.

A physicist can assess the action and the approximation rather than an unspecified antigravity generator. The result remains a speculative classical effective-theory candidate for gravitational lift. It should not be represented as a solution of quantum gravity or as a demonstrated solution of the movie's complete problem.

Primary references

1. M. K. Prasad and C. M. Sommerfield, *Exact Classical Solution for the 't Hooft Monopole and the Julia-Zee Dyon*, Phys. Rev. Lett. 35, 760 (1975). Publisher.
2. P. Forgacs and J. Gyurusi, *Static spherically symmetric monopole solutions in the presence of a dilaton field*, arXiv:hep-th/9508114; Phys. Lett. B 366, 205 (1996). Paper.
3. *Constraining the attractive fifth force in the general free scalar-tensor gravity with solar system experiments*, Eur. Phys. J. C (2024). Paper and author list. The calculation here uses its stated massless-force bound.
4. K. Maeda and D. Wands, *Dilaton-gravity on the brane*, arXiv:hep-th/0008188. Paper. Background for interpreting a scalar as a possible bulk degree of freedom, not an embedding of this candidate.

Reproducibility

The appendix contains the NumPy/SciPy calculation used for the numerical checks and parameter table. Run with Python 3 and installed NumPy/SciPy. It solves the static flat-space core boundary-value equations and calculates leading body forces; its scope is stated explicitly in its output.

Numerical check output


```
{
  "parameters": {
    "beta_ordinary": 0.001,
    "gamma_dark": 1000000.0,
    "ordinary_fifth_force_ratio": 2e-06,
    "ordinary_PPN_gamma": 0.9999960000079999,
    "bare_G": 6.674286651426696e-11,
    "dark_magnetic_mass_kg": 1000000.0,
    "core_length_m": 1.0,
    "v_GeV": 93854220.93347657,
    "g_dark": 2.1024838134691978e-24,
    "reduced_Planck_mass_GeV": 2.435325894660445e+18,
    "gamma_v_over_Mpl": 3.8538669974008776e-05,
    "source_compactness": 7.426145416827831e-22,
    "scalar_self_backreaction_estimate": 1.4852290833655656e-09,
    "source_rest_energy_J": 8.987551787368176e+22,
    "external_energy_to_charge_balanced_dyon_J": 3.7227658428584506e+22,
    "coupling_scale_Mpl_over_gamma_GeV": 2435325894660.4453
  },
  "core_checks": [
    {
      "alpha": 3.8538669974008776e-05,
      "bvp_max_rms_residual": 1.9966859421610525e-08,
      "dimensionless_mass": 0.9999999996672171,
      "scalar_charge_from_far_tail": 1.0000000002839453,
      "charge_mass_identity_absolute_error": 6.167282240454597e-10,
      "max_scaled_scalar_difference_from_BPS_first_order": 1.24572768767095e-10,
      "gamma_q_at_center_approx": 7.426144592050561e-10
    },
    {
      "alpha": 0.05,
      "bvp_max_rms_residual": 1.9946099434972803e-08,
      "dimensionless_mass": 0.9996331401342364,
      "scalar_charge_from_far_tail": 0.9996331403351649,
      "charge_mass_identity_absolute_error": 2.0092849606356822e-10,
      "max_scaled_scalar_difference_from_BPS_first_order": 0.00023410948935465026,
      "gamma_q_at_center_approx": 0.0012505851348345164
    }
  ],
  "craft_modes": [
    {
      "electric_to_magnetic_charge_ratio": 0,
      "dark_source_mass_kg": 1000000.0,
      "craft_mass_kg": 1000000000.0,
      "dark_source_scalar_coupling": -1000000.0,
      "craft_scalar_coupling": -999.999001,
      "outward_acceleration_in_units_of_normal_g": 0.999996002007996
    },
    {
      "electric_to_magnetic_charge_ratio": 0.6378381734566669,
      "dark_source_mass_kg": 1186101.8234192785,
      "craft_mass_kg": 1000186101.8234193,
      "dark_source_scalar_coupling": -421628.2616193013,
      "craft_scalar_coupling": -500.00000000004417,
      "outward_acceleration_in_units_of_normal_g": 8.837357601301043e-14
    },
    {
```

```
      "electric_to_magnetic_charge_ratio": 1,
      "dark_source_mass_kg": 1414213.5623730952,
      "craft_mass_kg": 1000414213.562373,
      "dark_source_scalar_coupling": 0.0,
      "craft_scalar_coupling": 0.0009985863719815245,
      "outward_acceleration_in_units_of_normal_g": -0.9999999971727497
    }
  ],
  "scope": "Classical weak-field model, core BVP and leading force only. No full perturbation spectrum, quantum completion, binding
     ↪ hardware, full cosmological fit, or 5D uplift was solved."
}
```


Calculation code

```
"""Independent numerical checks for a speculative classical field-theory candidate.

Uses NumPy/SciPy. This is not a claim of new physics or a full stability proof.
"""
import json
import math
import numpy as np
from scipy.integrate import solve_bvp, simpson
from scipy.optimize import brentq

GN = 6.67430e-11
C = 299792458.0
HBAR = 1.054571817e-34
GEV_J = 1.602176634e-10
GEV_KG = GEV_J / C**2
HBARC_GEV_M = HBAR * C / GEV_J
BETA = 1e-3
GAMMA = 1e6
GSTAR = GN / (1 + 2 * BETA**2)
M0_KG = 1e6
R0_M = 1.0
MO_KG = 999e6
V_GEV = math.sqrt(M0_KG * HBARC_GEV_M / (4 * math.pi * GEV_KG * R0_M))
GD = HBARC_GEV_M / (R0_M * V_GEV)
MPL_KG = math.sqrt(HBAR * C / (8 * math.pi * GSTAR))
MPL_GEV = MPL_KG / GEV_KG
ALPHA = GAMMA * V_GEV / MPL_GEV


def bps(x):
    w = x / np.sinh(x)
    h = 1 / np.tanh(x) - 1 / x
    wp = w * (1 / x - 1 / np.tanh(x))
    hp = 1 / x**2 - 1 / np.sinh(x)**2
    u = (1 - h*h) / 2
    up = -h * hp
    return np.array([w, wp, h, hp, u, up])


def check_core(alpha):
    # psi = gamma*q = alpha^2*u keeps tiny physical scalar amplitudes resolved.
    x0, xmax = 1e-3, 100.0
    x = np.unique(np.r_[np.geomspace(x0, 2, 400), np.linspace(2, xmax, 1200)])

    def fun(x, y):
        w, wp, h, hp, u, up = y
        f = np.exp(-2 * alpha**2 * u)
        s = wp**2 + (w*w - 1)**2 / (2*x*x)
        return np.vstack((wp,
            2*alpha**2*up*wp + w*(w*w-1)/x**2 + w*h*h/f,
```

```
            hp, -2*hp/x + 2*w*w*h/x**2,
            up, -2*up/x - 2*f*s/x**2))

    def bc(a, b):
        # Regular Taylor series at x0; Coulomb tails at xmax.
        core_b = (1-a[0]) / x0**2
        scalar_slope = -4*np.exp(-2*alpha**2*a[4])*core_b**2*x0
        return np.array([
            a[1] - 2*(a[0]-1)/x0,
            a[3] - a[2]/x0,
            a[5] - scalar_slope,
            b[0],
            b[3] + (b[2]-1)/xmax,
            b[5] + b[4]/xmax - 1/(2*xmax**3)
                + 2*alpha**2*b[4]/(3*xmax**3),
        ])

    sol = solve_bvp(fun, bc, x, bps(x), tol=2e-8, max_nodes=30000)
    if not sol.success:
        raise RuntimeError(sol.message)
    grid = np.geomspace(x0, xmax, 20000)
    w, wp, h, hp, u, up = sol.sol(grid)
    s = wp**2 + (w*w-1)**2 / (2*grid**2)
    energy_density = np.exp(-2*alpha**2*u)*s + .5*grid**2*hp**2 + w*w*h*h + .5*alpha**2*grid**2*up**2
    end = sol.sol(xmax)
    ch = xmax**2 * end[3]
    charge = (-xmax**2*end[5] + 1/xmax) / (1 + alpha**2/xmax**2)
    tail = (1 + ch**2 + alpha**2*charge**2)/(2*xmax) - alpha**2*charge/xmax**2 + alpha**2/(6*xmax**3)
    energy = float(simpson(energy_density, x=grid) + tail)
    ref = bps(grid)
    scalar_error = float(np.max(np.abs(u-ref[4])))
    return {
        'alpha': alpha,
        'bvp_max_rms_residual': float(np.max(sol.rms_residuals)),
        'dimensionless_mass': energy,
        'scalar_charge_from_far_tail': float(charge),
        'charge_mass_identity_absolute_error': abs(energy-charge),
        'max_scaled_scalar_difference_from_BPS_first_order': scalar_error,
        'gamma_q_at_center_approx': float(alpha**2 * sol.sol(x0)[4]),
    }


def craft(zeta):
    md = M0_KG*math.sqrt(1+zeta*zeta)
    ad = GAMMA*(zeta*zeta-1)/(zeta*zeta+1)
    mt = MO_KG + md
    ac = (BETA*MO_KG + ad*md)/mt
    radial_a_over_g = -(1+2*BETA*ac)/(1+2*BETA**2)
    return {'electric_to_magnetic_charge_ratio': zeta,
            'dark_source_mass_kg': md, 'craft_mass_kg': mt,
            'dark_source_scalar_coupling': ad,
            'craft_scalar_coupling': ac,
            'outward_acceleration_in_units_of_normal_g': radial_a_over_g}


root = brentq(lambda z: craft(z)['outward_acceleration_in_units_of_normal_g'], 0, 1)
result = {
    'parameters': {
        'beta_ordinary': BETA, 'gamma_dark': GAMMA,
        'ordinary_fifth_force_ratio': 2*BETA**2,
        'ordinary_PPN_gamma': (1-2*BETA**2)/(1+2*BETA**2),
        'bare_G': GSTAR, 'dark_magnetic_mass_kg': M0_KG,
        'core_length_m': R0_M, 'v_GeV': V_GEV, 'g_dark': GD,
        'reduced_Planck_mass_GeV': MPL_GEV,
        'gamma_v_over_Mpl': ALPHA,
        'source_compactness': GSTAR*M0_KG/(R0_M*C*C),
        'scalar_self_backreaction_estimate': ALPHA**2,
        'source_rest_energy_J': M0_KG*C*C,
```

```
        'external_energy_to_charge_balanced_dyon_J': (math.sqrt(2)-1)*M0_KG*C*C,
        'coupling_scale_Mpl_over_gamma_GeV': MPL_GEV/GAMMA,
    },
    'core_checks': [check_core(ALPHA), check_core(0.05)],
    'craft_modes': [craft(0), craft(root), craft(1)],
    'scope': 'Classical weak-field model, core BVP and leading force only. No full perturbation spectrum, quantum completion,
     ↪ binding hardware, full cosmological fit, or 5D uplift was solved.'
}
assert result['core_checks'][0]['charge_mass_identity_absolute_error'] < 2e-6
assert result['core_checks'][1]['charge_mass_identity_absolute_error'] < 2e-6
assert result['craft_modes'][0]['outward_acceleration_in_units_of_normal_g'] > .99
assert abs(result['craft_modes'][1]['outward_acceleration_in_units_of_normal_g']) < 1e-10
assert result['craft_modes'][2]['outward_acceleration_in_units_of_normal_g'] < -.99
print(json.dumps(result, indent=2))
```