

THEORY AND ENGINEERING DESIGN OF CONTINUOUS HARMONIC SGDM GRAVITON PROPULSION DRIVE

Propellantless Sinusoidal Drive with 4-Phase Modulation and 5-Motor Power Assembly (Patents #3 & #4)

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Theoretical Basis: Stochastic Gravitodynamics of the Multiverse (SGDM) • DOI: 10.5281/zenodo.23191063

Energy Balance: 100% Convergence of Mechanical Work and Electrical Power (\$N=Fv\$, \$\eta=90\%\$, Earth-Mars in 90 days)

1. Introduction: Overcoming Tsiolkovsky's Rocket Equation

In classical astronautics, Tsiolkovsky's rocket equation $\Delta v = v_{ex} \cdot \ln(M_0 / M_{dry})$ demands burning **1,324 tons of chemical propellant (22 rail tank cars)** to deliver a 1.0-ton payload to Mars. In SGDM theory, the physical vacuum is a dense physical **Graviton Ocean** endowed with nuclear density $\rho_0 \approx 3 \cdot 10^{17} \text{ kg/m}^3$ and secular spin polarization $N_g = A$. Unidirectional propellantless thrust is generated via dynamic phase interference of precessing rotors with the metric background, strictly preserving momentum conservation: $P_{vessel} + P_{Ocean} \equiv 0$.

2. Kinematic Architecture and 5-Motor Propulsion Assembly

The propulsion unit is rigidly anchored to the structural frame of the spacecraft and integrates 5 synchronized electric drives:

- Central Bearing Frame — rigidly bolted to the hull bulkheads, directly transmitting continuous forward thrust $+F_z$;
- Motors 1 & 2 (Z-Stabilizers, 10% + 10%) — counter-rotating coaxial rotors ($\pm\omega_z$) ensuring $L_z \equiv 0$ and vertical gyro-stability;
- Motors 3 & 4 (Gyro Rotors, 20% + 20%) — counter-rotating pair ($\pm\omega_x$) mounted on lever arms L with gear ratio $R_{gear} = L$;
- Motor 5 (Main Precession Drive, 40%) — drives the precession hub around vertical Z at variable speed $\Omega_p(t)$, handling 40% of peak torque load.

3. Fundamental SGDM Thrust Derivation

The resultant propellantless thrust in cosmic vacuum strictly obeys Chesnokov's canonical formula (Patent #3):

$$F_{thrust} = \kappa_{SGDM} \cdot [m_{rot} \cdot R_{rot}^2 \cdot \omega_x \cdot \Omega_p] / c \Rightarrow a_{vessel} = F_{thrust} / M_{vessel} \quad (1)$$

- F_{thrust} — resultant propellantless thrust in space vacuum (for a 1-ton ship on a 90-day trajectory: $F = 5.18 \text{ N} = 0.528 \text{ kgf}$);
- $\kappa_{SGDM} \approx 1.37$ — dimensionless quantum-graviton coupling coefficient with the Multiverse background metric;
- m_{rot}, R_{rot} — total mass and radius of active gyro rotors ($4 \times 2.5 \text{ kg} = 10 \text{ kg}$, $R = 0.20 \text{ m}$);
- ω_x, Ω_p — angular speeds of spin ($\pm 60,000 \text{ RPM} = 6,283 \text{ rad/s}$) and hub precession ($\pm 330 \text{ RPM} = 34.6 \text{ rad/s}$);
- $c = 299,792,458 \text{ m/s}$ — fundamental speed of light; $M_{vessel} = 1,000 \text{ kg}$ (1.0 ton).

4. Continuous 4-Phase Sinusoidal Cycle (Harmonic Law)

Complete elimination of dead time and mechanical impacts is achieved via the **Law of Predictive Harmonic Phase Modulation**:

Phase	Rotor State $\omega_x(t)$	Precession $\Omega_p(t)$	Thrust $F_z(t)$	Physical Mechanism in Assembly
Phase 1	$+\omega_{max}$ (forward)	$+\Omega_p \uparrow$ (Z ramp-up)	$+F_{max} \uparrow$	Direct precession ramp-up, smooth forward thrust build-up (+Z).
Phase 2	$\omega_x \rightarrow 0 \rightarrow -\omega$	$\Omega_p \approx \Omega_{max}$	$F_z \text{ softly } \rightarrow 0$	Predictive rotor braking through 0 exactly at peak Ω_p . Zero shock loads.
Phase 3	$-\omega_{max}$ (reverse)	$-\Omega_p$ (Z deceleration)	$+F_{max} \uparrow$	Minus times minus gives PLUS! Precession deceleration pushes ship FORWARD (+Z).
Phase 4	$-\omega \rightarrow 0 \rightarrow +\omega$	$\Omega_p \rightarrow 0$ (Z stop)	$F_z \text{ softly } \rightarrow 0$	Synchronous hub stop and predictive rotor re-acceleration to $+\omega$. Seamless cycle repeat.

Thrust profile follows a sine-squared law: $F_{thrust}(t) = F_{max} \cdot \sin^2(\omega_0 t) \geq 0$. Thrust acts 100% forward in time, dynamic jerk is strictly zero (Jerk $\equiv 0$), and kinetic energy is recirculated in a resonant LC-tank with >97% recovery efficiency.

5. Engineering Energy Balance (Earth-Mars 1.0 t Mission in 90 Days)

Rigorous verification of flight mechanics and electric power consumption under the power law $N(t) = F \cdot v(t)$ at efficiency $\eta = 90\%$:

Flight / Propulsion Parameter	Symbol	Formula / Basis of Calculation	Value	Units
Spacecraft Total Mass	M_0	Dry structural mass with payload	1,000	kg (1.0 ton)
Earth-Mars Transfer Distance	S	Mean planetary opposition distance	78.3×10^6	km
Transit Duration (Burn + Brake)	T	45 days acceleration + 45 days braking	90.0 (2,160)	days (hours)
Continuous Cruise Acceleration	a	$a = 2S_1 / t_1^2$ ($S_1 = 39.15 \text{ M km}$)	0.00518	m/s^2 (0.00053 g)
Propellantless Cruise Thrust	F_{thrust}	$F = M_0 \cdot a$	5.18 (0.528)	N (kgf)
Max Velocity at Inflection Point (Day 45)	v_{max}	$v_{max} = a \cdot t_1$ ($t_1 = 45 \text{ days}$)	20.14 (72,500)	km/s (km/h)
Total Mechanical Work Done	A_z	$A_z = F_{thrust} \cdot S$	112,660 (405.6)	kWh (GJ)

Total Electrical Energy ($\eta=90\%$)	E_{el}	$E_{el} = A_z / 0.90$	125,180 (450.6)	kWh (GJ)
Mean Power Draw (Hourly Consumption)	P_{mean}	$P_{mean} = E_{el} / 2,160 \text{ h}$	57.95 (78.9)	kW (hp)
Peak Power Draw (Day 45 Peak)	P_{peak}	$P_{peak} = (F \cdot v_{max}) / 0.90$	115.9 (157.8)	kW (hp)
Rocket Fuel Mass Consumed	ΔM_{fuel}	Eliminating 1,324 t chemical propellant	STRICTLY 0.00	kg (NONE)

6. Power Allocation Across 5 Electric Motors

Total installed electrical power (58.0 kW mean / 116.0 kW peak) is strictly allocated across the 5 drive units:

Motor Unit & Function	Power Share	Mean Power Draw	Peak Power Draw	Mass & Drive Architecture
M1: Z-Stabilizer 1 (+ ω_z)	10%	5.80 kW (7.9 hp)	11.60 kW (15.8 hp)	4.5 kg, high-speed brushless DC
M2: Z-Stabilizer 2 (- ω_z)	10%	5.80 kW (7.9 hp)	11.60 kW (15.8 hp)	4.5 kg, counter-rotating ($L_z \equiv 0$)
M3: Gyro Rotor 1 (+ ω_x)	20%	11.60 kW (15.8 hp)	23.20 kW (31.6 hp)	8.0 kg, motor-generator with LC-recovery
M4: Gyro Rotor 2 (- ω_x)	20%	11.60 kW (15.8 hp)	23.20 kW (31.6 hp)	8.0 kg, motor-generator with LC-recovery
M5: Main Precession Drive (Ω_p)	40%	23.20 kW (31.6 hp)	46.40 kW (63.1 hp)	15.0 kg, high-torque Z servo unit
TOTAL POWER ASSEMBLY (5 MOTORS)	100%	58.00 kW (78.9 hp)	116.00 kW (157.8 hp)	Total motor mass: 40.0 kg

7. Conclusions and Patent Claims Summary

1. 100% Energy Balance Convergence: Mechanical work done in transferring a 1.0-ton spacecraft to Mars in 90 days ($A_z = 112,660$ kWh) is strictly accounted for by onboard electrical energy ($E_{el} = 125,180$ kWh at $\eta = 90\%$).
2. Off-the-shelf Feasibility: Mean power requirement is only **58 kW (79 hp)** with peak at **116 kW (158 hp)** , readily supplied by a 60–80 m² solar array or compact RTG/reactor.
3. Eliminating 1,324 Tons of Chemical Fuel: Propellantless interplanetary flight is achieved at zero mass expulsion with constant 1.0-ton dry mass.

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