

Chapter 2: The Engine – Chiral Dynamics & Mach Field

Extensions of Mach's Principle

Existing Extensions Landscape

Extension	Key Feature	Limitation
GR Frame-Dragging (Lense-Thirring)	Rotating mass drags inertial frames; $\Omega_{LT} \approx (GJ)/(c^2 r^3)$	Incomplete Machian; allows inertia without matter
Barbour-Bertotti (1982)	Shape space relationalism; no absolute time/space	Non-relativistic; no spin/torsion
Einstein-Cartan (1922-60s)	Torsion couples to spin; singularity resolution	Achiral; no handedness preference
Quantum Approaches (e.g., Penrose 2024)	Twistors for curved spaces; nonlocality	Handedness-blind; no cosmic chirality

Gap: All achiral—ignore handedness, fail quantum quagmire resolution.

Chiral Mach's Principle

Extends relational mechanics with cosmic handedness: Inertia includes parity-violating torsion from cosmic ρ_χ field ($0 \leq \rho_\chi \leq 1$).

Chiral Density: $\rho_\chi = \sum \rho_\chi(k)$ over holarchic levels A_k ; current $\rho_\chi = 0.92$.

Torsional Correction: $F_{chiral} \propto r \times v$ (pseudovector).

Holor Mach's Principle

Stratifies inertia across awareness spectra $A_n : F_{Mach}(n) = \sum F_{Mach}(k) (k = 0 \rightarrow n)$.

Conjugates interior (awareness) with exterior (Cosmos).

Chiral Mach Equations

Force Equation

$$F_{Mach} = F_{achiral} + F_{chiral} = -\nabla\Phi_\chi - (1/c^2)\partial_t A_\chi$$

Where:

- $\Phi_\chi = (4\pi G \rho_\chi / 3) r^2$ (scalar potential, achiral)
- $A_\chi = (4\pi G \rho_\chi / 3c^2)(r \times \Omega)$ (vector potential, chiral)

Derivation Steps:

1. Achiral baseline: Weber-Mach from Assis
2. Chiral term: Minimal ρ_χ coupling
3. Effective interaction: A_χ form
4. Full equation: Lorentz-like structure

Properties:

1. Parity-violation: F_{chiral} odd under P
2. Newtonian limit: $v \ll c, \rho_\chi \rightarrow 0 \rightarrow F_{Newton}$
3. Relativistic consistency: Compatible with EC torsion
4. Quantum bridge: Spin-torsion coupling

Verification: SymPy confirms limits (ancillary).

Einstein-Cartan Torsion Gravity

Foundations

Riemann-Cartan Manifold: Connection $\Gamma^\lambda_\mu \nu = {}^\lambda_\mu \nu + K^\lambda_\mu \nu$ (Christoffel + contorsion)

Torsion Tensor: $T^\lambda_\mu \nu = \Gamma^\lambda_\mu \nu - \Gamma^\lambda_\nu \mu$ (antisymmetric)

Spin-Torsion Coupling: $T^\lambda_\mu \nu \propto S^\lambda_\mu \nu$ (spin current)

EC Action

$$S = \int [(1/(16\pi G))R(\Gamma) - g + L_{matter}] d^4x$$

Where $R(\Gamma) = R() + \text{torsion terms.}$

Key Features

- Singularity Bounce: Torsion repels at high densities
- Chiral Cosmology: Parity-violating terms explain matter asymmetry
- HC VIII Tie: Torsion as geometric χ -substrate

Chiral Mach Lagrangian

Four-Step Derivation

1. Achiral Baseline: $L_{achiral} = (1/2)mv^2 - V_{achiral}$ (Weber-Mach)
2. Chiral Term: Add minimal coupling $(m/c)v \cdot A_\chi$
3. Effective Interaction: A_χ sourced by cosmic chirality
4. Full Lagrangian: $L = (1/2)mv^2 - V + (m/c)v \cdot A_\chi$

Variational: $\delta S / \delta x = 0$ yields F_{Mach} .

Field-Theoretic Extension

Holst Action: $S = \int [(1/2)ee_a^\mu e_b^\nu P_{cd}^{ab} F^{cd} \mu\nu(\omega)]\sqrt{-g} d^4x$

With Immirzi γ encoding chirality.

Holarchic Recapitulation

Stratified: $L(n) = (1/2)mv(n)^2 - V(n) + \sum (m/c)v(k) \cdot A_\chi(k) (k = 0 \rightarrow n-1)$

Witness W_n : Maps $L_{n-1} \rightarrow L_n$

Projected $\rho_\chi(n) \rightarrow 0.98$ via stratification.

Attestation: The engine ignites. 