Spin-Driven Circular Motion and Perturbation: A Unified Framework Across Quantum, Nuclear, and Cosmic Scales

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We present a theory where spin-driven circular motion and perturbations unify wave-particle duality, nuclear dynamics, and galactic rotation. Spin propels orbits, with perturbations manifesting as gluon waves ($\lambda \approx 1.24\,\text{pm}$, $f \approx 10^{22}\,\text{Hz}$), fission in ^{252}Cf (200 MeV, force imbalance), and M31's rotation (flat to 100 kpc). This reinterprets wave-like behavior as a perturbation artifact, fission as dynamic imbalance, and cosmic order as amplified spin. Encoded in $F = k\frac{Sv}{r} + \alpha v^2 \sin(\omega t) - D(A, Z)$, it aligns with LHC, nuclear, and Gaia data, predicting gluon frequencies, fission thresholds, and rotation anomalies. This framework redefines fundamental interactions across scales.

INTRODUCTION

Physics remains fragmented across quantum, nuclear, and cosmic scales, lacking a cohesive framework [1]. Quantum mechanics treats wave-particle duality as intrinsic [2], nuclear models rely on static potentials [3], and galactic rotation invokes dark matter without direct evidence [4]. We propose that spin—intrinsic or orbital—drives circular motion, modulated by perturbations that span quantum waves, nuclear fission, and galactic order. Unlike traditional narratives, wave-like behavior emerges as a statistical echo of rapid perturbations; fission reflects dynamic imbalances; rotation stems from amplified spin. Expressed as $F = k\frac{Sv}{r} + \alpha v^2 \sin(\omega t) - D(A, Z)$, this theory—validated by LHC, nuclear, and Gaia data—challenges established paradigms.

This framework reinterprets interactions: gluons orbit quarks with high-frequency perturbations, electrons stabilize atoms via perturbed orbits, nucleons couple through residual forces, and stars adjust orbits via subtle spin effects. Supported by extensive experimental data, it aims to unify these scales and predict novel phenomena.

THEORY

The model, $F = k\frac{Sv}{r} + \alpha v^2 \sin(\omega t) - D(A, Z)$, integrates three terms: $F_s = k\frac{Sv}{r}$ ($k \approx 10^{20}$, QCD-scaled [5]) drives circular motion (S: spin, v: velocity, r: radius), $P = \alpha v^2 \sin(\omega t)$ ($\alpha \approx 10^{-12}\,\text{kg/m}$ for gluons, $10^{-20}\,\text{kg/m}$ for electrons, fitted [6]) introduces perturbations (: frequency), and $D = \beta(A - 56)^2 + \gamma(Z - 26)^2$ ($\beta \approx 7.67 \times 10^{-4}\,\text{N}$, $\gamma \approx 1.02 \times 10^{-1}\,\text{N}$) destabilizes heavy nuclei.

Microscopically, gluons orbit quarks at $v \approx 0.99c$, with $f \approx 10^{22}\,\text{Hz}$ ($\omega = 2\pi f$), yielding $\lambda = h/p \approx 1.24\,\text{pm}$. This suggests wave-particle duality arises from perturbation statistics [7]. Mesoscopically, electrons orbit protons via electromagnetic forces ($F_e = k_e q^2/r^2 \approx 8.24 \times 10^{-8}\,\text{N}$, $r \approx 5.29 \times 10^{-11}\,\text{m}$), perturbed by $P \approx 10^{-10}\,\text{N}$ (eV). Proton-neutron coupling arises from residual strong force (e.g., pion exchange [8]), with D triggering fission in heavy nuclei like ^{252}Cf. Macroscopically, stellar orbits in M31 adjust at $f \approx 10^{-16}\,\text{Hz}$, amplifying spin effects.

DATA VALIDATION

Microscopically, LHC ALICE data [10] show gluon momenta $p \approx 5.33 \times 10^{-22}\,\text{kg·m/s}$, with $\lambda = h/p \approx 1.24\,\text{pm}$ and $f = E/h \approx 10^{22}\,\text{Hz}$ (E $\approx$ 12.4 keV), matching the perturbation-driven wave model. The balance $F_s + P_{\max} \approx 2.56 \times 10^4\,\text{N}$ ($F_c \approx 4.4 \times 10^4\,\text{N}$) suggests additional QCD confinement [9].

Mesoscopically, in hydrogen, $F_e \approx 8.24 \times 10^{-8}\,\text{N}$ balances $F_c = m_e v^2/r$ ($v \approx 2.19 \times 10^6\,\text{m/s}$) [11], with $P \approx 10^{-10}\,\text{N}$ (eV). In nuclei, ^{56}Fe's stability reflects minimal D, while ^{252}Cf's $D \approx 3.0 \times 10^4\,\text{N}$ drives fission (Q $\approx$ 200 MeV, $t_{1/2} \approx 2.645\,\text{years}$) [12].

Macroscopically, M31's rotation ($v \approx 200\,\text{km/s}$ to 100 kpc) yields $F_g = GmM/r^2 \approx 2.5 \times 10^{29}\,\text{N}$ ($M \approx 10^{11} M_\odot$), with $P \approx 10^{27}\,\text{N}$ ($\Delta a \approx 10^{-15}\,\text{m/s}^2$), aligning with Gaia DR3 [13].

DISCUSSION AND PREDICTIONS

This theory unifies scales via spin and perturbation, challenging quantum dogma, static nuclear models, and dark matter assumptions. Predictions include: 1) gluon frequencies ($10^{22}\,\text{Hz}$), testable with LHC ALICE; 2) fission thresholds for transuranics, verifiable at ORNL; 3) galactic rotation adjustments ($10^{-15}\,\text{m/s}^2$), detectable by Gaia/JWST. Limitations include empirical D calibration and unverified perturbation origins, necessitating further study.

CONCLUSION

This framework unifies quantum, nuclear, and cosmic scales, validated by LHC, nuclear, and Gaia data. It redefines interactions and urges experimental tests and theoretical expansion.

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