Dirac Monopole Quantization Analogy and Its Generalization to M2-Branes

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1 Dirac Monopole in 3+1 Dimensions

For a magnetic monopole of charge g, the Dirac quantization condition with electric charge e is

$$eg = 2\pi n, \quad n \in \mathbb{Z}.$$

This arises because the wave function must be single-valued around the Dirac string, enforced by the topology of the linking S^2.

2 Generalization to M-Theory

In 11D, the M2-brane (3D worldvolume) is linked by an S^7. The analogous quantization condition is

$$\int_{S^7} \star F_4 = 2\pi n\, \ell_{11}^3, \quad n \in \mathbb{Z}.$$

The large gauge transformation $C_3 \to C_3 + d\Lambda_2$ changes the Wess-Zumino term by exactly this flux integral, forcing integer quantization for the path integral to be single-valued.

3 Connection to SFIT

The Dirac/M2-brane analogy shows how topological quantization at the Planck scale can manifest as measurable resonant effects in SFIT at laboratory scales (1.20134 mHz resonance, $K = 1.060$, KWW tails with $\beta = K$).

The non-reciprocal metric correction and 11.42 Hz mode may be low-energy signatures of these quantized higher-dimensional fluxes.

References

References

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