

Explaining Geomagnetic Field Reversals Using the Modified Rikitake Model

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According to established paleomagnetic data, the polarity of Earth's magnetic field reverses with irregular periodicity, averaging five inversions per million years. Although numerous theories exist regarding the drivers of these reversals (most notably the Milankovitch cycles hypothesis), the issue fundamentally pertains to the geodynamo problem. Current geodynamo theories, however, remain unable to fully explain the periodicity of inversion cycles. Furthermore, numerical simulations of the geodynamo present a significant computational challenge due to the extreme parameter values of Earth's outer core. Consequently, the use of simplified models is essential. One such model is the Rikitake two-disc dynamo, which, unlike the earlier Bullard model, is characterized by inherent chaotic inversions.

The objective of this work is to develop a mechanism for controlling this chaotic dynamics. As is well-established, chaotic dynamics can be modulated by the introduction of an external constant component. This paper justifies the existence of such a governing parameter, linking it to the intergalactic magnetic field.

References

[1] Kharshiladze, O. A., Tsulukidze, L. K., Kezua, L. B., & Zilpimiani, D. O. (2025). Control of Inversions of the Earth's Magnetic Field with Rikitake's Model. *Journals of Georgian Geophysical Society*, 28(2).