

Earth's magnetic field and parallel action

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The magnetic field of the earth is uniform on its surface. The resultant Lorentz force a uniform magnetic field exerts on a coil of any shape is zero. The torque perpendicular to a flat coil is also zero. So, a current carrying coil in the magnetic field of the earth should stay immobile. However, my experiment shows that the test coil rotates in its plane. See the video of this experiment:

<http://youtu.be/JKMG8jY1RRg>

1. Explanation of the video

Title: **Earth's magnetic field and parallel action**

1. The 3 turns test coil is a flat 9 cm x 9 cm square. It is free to rotate in its plane and its axis is in the North-South direction.
2. When the current is on, the coil rotates in its plan, showing a non-zero torque.
3. The axis is rotated 90° to align with the East-West direction.
4. The coil still rotates, showing torques in both directions.

Conclusion: For our flat test coil in earth's uniform magnetic field, classical theory predicts zero torque. But in this experiment the test coil is deflected. Only a force having parallel-to-current component can explain these torques.

Bonus: Lorentz force on a straight current in the magnetic field of the earth

5. The suspended wire
6. When the current is on, the wire moves.
7. When the current makes the wire resonate, the swing is amplified.

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2. Conclusion

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