



Faraday's Final Riddle

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This is a supplement to the paper New Magnetism (the fifth paper in the New Electromagnetism Series.).



ABSTRACT

This text explores Faraday's Homopolar Generator (HPG). Although the general principles of operation of the generator can be found in many text books, there are modes of operation that seem to contradict the theory of Relativity and for that matter classical electromagnetic principles.

This paper will briefly describe the HPG along with the different modes of operation that lead to the above mentioned contradictions. This paper will explore the impact of the contradictions to mainstream science.

The paper titled "New Magnetism" (nm.pdf) provides a new model for magnetism that explains each of the modes of operation of the HPG without contradicting the Theory of Relativity. New Magnetism will not be discussed in this supplement.

Rev 1.2 of document discusses other theories which attempt to explain the paradoxical behavior of the HPG.

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1 The Homopolar Generator

Faraday developed a generator consisting of a disk magnet coaxial to a conductive disk similar to the diagram shown in Figure 1-1. This generator is called a Homopolar generator because it only uses one pole of the magnet. There are 4 modes of operation of the Homopolar Generator (HPG); the results of which comprise what is known as Faraday's Final Riddle: Does a magnetic field move with the magnet.

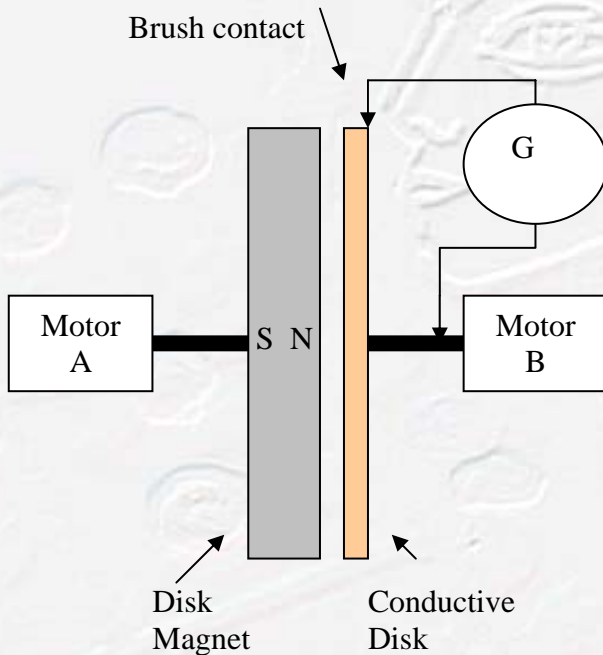


Figure 1-1: Faraday's homo-polar generator

The generator in Figure 1-1 is comprised of a disk magnet attached to a motor (A) and a conductive copper disk attached to motor (B). The disks are placed next to each other to allow them to rotate coaxial to each other. A stationary galvanometer is connected between the edge of the conductive disk and the shaft of motor B with brush contacts. The Galvanometer enables the operator to detect radial current generated in the disk (An indication that power is being generated).

There are four modes of operation of the Homopolar generator. Some of the modes of operation are not discussed in text books since there is no accepted explanation for the seemingly paradoxical behavior of the HPG. In the following descriptions, the disk magnet is referred to as the magnet and the conductive copper disk is referred to as the disk.

In the first mode of operation, both the disk and the magnet are stationary. In this mode of operation, the Galvanometer does not detect the flow of current and thus we conclude that there is no power generated in the disk.

In the second mode of operation, the magnet is stationary and the disk is rotated by motor B. In this mode, the galvanometer detects power generated in the disk. A normal reaction is to conclude that power is generated when there is relative motion between the disk and the magnet.



In the third mode of operation, the magnet is rotated by motor A and the disk is stationary. One might try to predict that power should be generated since there is relative motion between the disk and the magnet (such as in mode 2); however, no power is detected.

In the fourth mode of operation, both the magnet and the disk are rotated together. Again one may conclude that since there is no relative motion between the disk and the magnet (such as in mode 1) that there should be no power generated; however, power is generated.

2 The Theory of Relativity

Einstein predicted from his Theory of Relativity that a magnetic field must move with the magnet. From observation of the HPG we find that the generated power is totally independent of the rotational velocity of the magnet. The generated power is only proportional to the rotational velocity of the disk. In order to reconcile the observations of the HPG with classical electromagnetism we must conclude that the flux lines are stationary regardless of the motion of the magnet. This contradicts Einstein's prediction that the flux lines must move with the magnet. New Magnetism shows that Einstein is correct; the flux lines are in motion when the magnet is rotated. New Magnetism explains all of the modes of operation of the Homopolar generator without contradiction to Einstein's Relativity.

3 Other Theories

There are many who profess that the paradoxical behavior of the HPG can be explained by considering the brush circuit.

In the fourth mode of operation where the magnet and disk rotate together, there is no cutting of the flux by the disk since it is assumed that the flux and disk rotate together. In this mode, if we assume that the flux moves with the magnet, then the only thing that "cuts" the flux is the brush circuit. If one were to apply the mathematics to this example you will obtain the correct result for the emf generated.

New Magnetism (see the New Magnetism Book SKU BK001) model shows that there is absolutely no contribution from the brush circuit since it is not in motion.

We will be publishing a free document in the weeks ahead which features a simple experiment that demonstrates that the brush circuit is not the source of the "paradoxical emf" in any mode of operation. The experiment will prove quite simply that the energy is only developed in the disk. The book New Magnetism now contains software that enables an experimenter to calculate the emf generated in any mode of operation of the HPG.

We will be publishing a lot of free work on the Homopolar in a new section of our website devoted entirely to the subject.

4 Conclusion

New Magnetism provides a simple solution to the HPG which explains all modes of operation without contradicting the Theory of Relativity. The explanation provided by New Magnetism also shows that a magnetic field is a spherical field and not a donut shaped field as described by the Biot-Savart model classical electromagnetism.