Phone: 417.347.7431
Fax: 417.374.7442
service@gosciencecrazy.com
1747 North Deffer Drive
Nixa, Missouri 65714

Helmholtz Coil
#HEMCOIL

Warning:

- **Not a toy; use only in a laboratory or educational setting.**
- **California Proposition 65 Warning: This product may contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.**

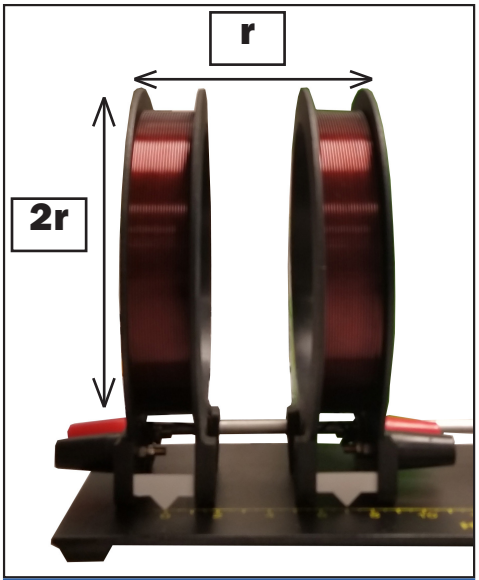
Introduction

Named after German physicist Hermann von Helmholtz, the Helmholtz Coil is useful for creating a region of uniform magnetic field. This region of magnetic uniformity is useful in many applications. One use is canceling out various magnetic interferences, such as the Earth's magnetic field, which is a necessary step in testing and calibrating some electronics for susceptibility to magnetic interference.

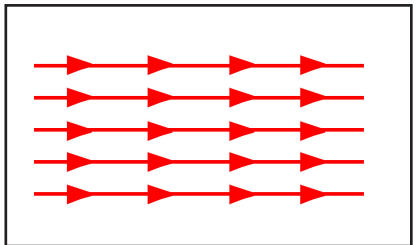
This device works by placing two identical solenoids parallel to each other in the same plane and running electricity through them. As electricity runs through each solenoid, a magnetic field is generated. By correctly spacing the solenoids apart, this magnetic field becomes uniform in the space between them.

The solenoids in this apparatus are 5" (12.7cm) in diameter and have 440 wraps of enameled copper each. There is also an area with a clamp in order to secure any accessories to the device that you choose to experiment with.

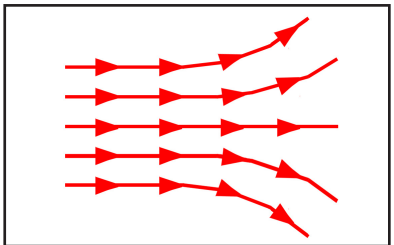
Not included: Power Source, Experimental Accessories (Magnetic field sensor, bar magnet, compass, etc...)



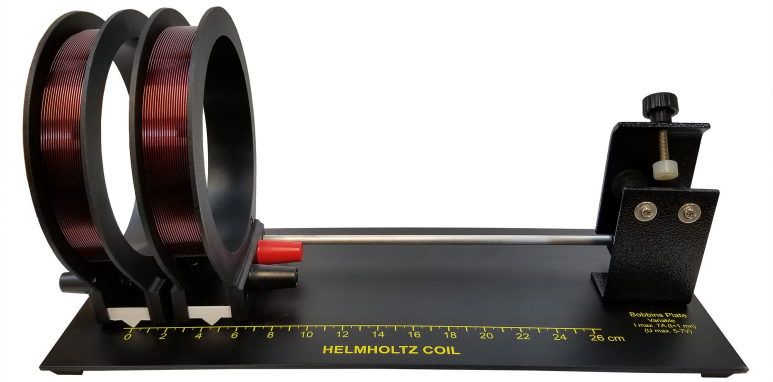
r =Radius of Solenoid Coil



Uniform Magnetic Field



Non-Uniform Magnetic Field



How to Use

Below are instructions on how to create various fields and how to calculate their strength:

Creating a Uniform Magnetic Field

1. Measure the radius *(r)* of the solenoid coils. Slide the coils so that they are *r*-distance apart from each other. **(Note:** Experiment with different distances to observe the field's lack of uniformity at other distances.**)**
2. Locate a power source (not included). Plug the power supply into the solenoids so that electricity flows through them in the same direction. **(Note:** Experiment with connecting the solenoids in a series or a parallel circuit to see if that affects the aspects of the field.**)**

Creating a Quadrupole Magnetic Field

1. Repeat the steps above, but, instead of plugging the power supply in so that electricity flows in the same direction in each solenoid, set up the power supply so that electricity in the second solenoid flows opposite of the electricity in the first.

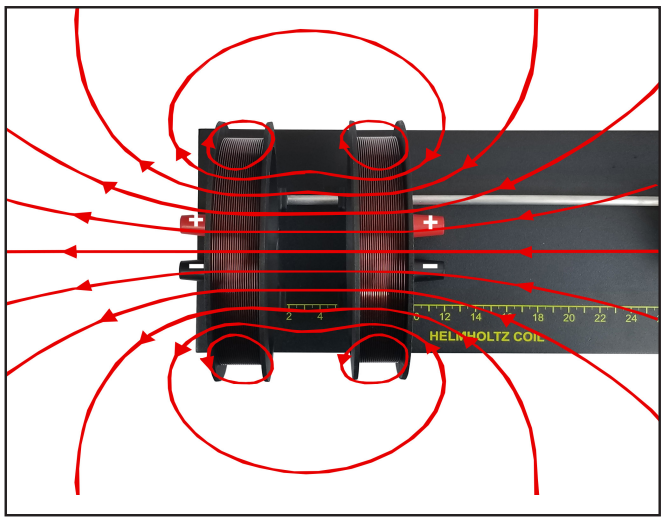
Calculating the Field Strength

1. Use the formula below to calculate the strength of the magnetic field at the exact midpoint between the solenoids, measured in Teslas.
2. Experiment with the current (amperage) passing through the solenoid coils. **(Note:** This device can take a **maximum of 7A.)**

$$B = \left(\frac{4}{5}\right)^{3/2} \cdot \left(\frac{\mu_0 nI}{r}\right)$$

- **B = Strength of the magnetic field (Teslas)**
- **μ_0 = Permeability Constant (1.26 x 10-6 T • m/A)**
- **n = Number of wraps in each solenoid (440 in this device)**
- **I = Current (Amperes); 7A max**
- **r = Radius of Solenoid Coil (Meters)**

Uniform Magnetic Field



Quadrupole Magnetic Field