

Superposition of two magnet fields of coils (Item No.: P6300569)

Curricular Relevance



Difficulty



Difficult

Preparation Time



10 Minutes

Execution Time



20 Minutes

Recommended Group Size



2 Students

Additional Requirements:

- Tablet with measure App
- Power Supply

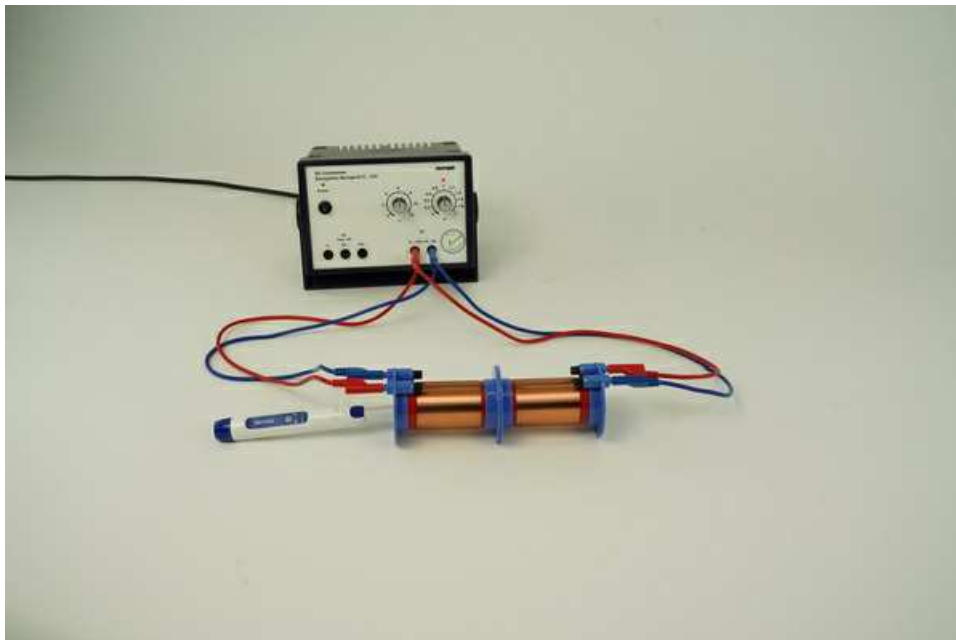
Experiment Variations:

Keywords:

Magnetic flux density, magnetic field of two coils, Superposition of magnetic fields

Information for teachers

Introduction



Application

Mostly the superposition of two electric field is better known. Magnetic field having also a superposition. In this experiment you'll examine this superposition.

The Helmholtz coil is an example for the superposition of two magnetic fields of two coils.

Educational objective!

In this experiment, the magnetic flux density along two coils is to be measured. The superposition of two fields is examined. In the first part of the experiment, the two magnetic fields are in the same direction and in opposite direction in the second part.

Task

1. Measure the magnetic flux density along two coils. The coils have the same polarity so that the superposition of the magnetic

field is positiv.

2. Measure the magnetic flux density along two coils. The polarity of one coil is reversed so that the superposition of the magnetic field is negativ.

Prior knowledge

The students should have already gained experience concerning the basics of direct and alternating current as well as the principle of magnetic induction. You can make a link to the superposition of two electric fields.

Principle

The principle of the superpositon of two fields is:

$$\vec{D} = \sum \vec{D}_i$$

Notes concerning the set-up and execution of the experiment

When measuring the magnetic field of the coil, make sure that the magnetic sensor indicates the magnetic flux density at the tip of the magnetic sensor. Look how is the polarity of the coils.

Equipment

Position No.	Material	Order No.	Quantity
1	Cobra SMARTsense - 3-Axis Magnetic field	12947-00	1
2	Induction coil, 200 turns, d = 40 mm	11007-05	2
3	Ruler, l = 30 cm	09851-40	1
4	Connection cord, 32 A, 500 mm, rot	07361-01	2
5	Connection cord, 32 A, 500 mm, blau	07361-04	2
6	PHYWE power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

Safety information

For this experiment, the general notes and intructions concerning safe experimentation in science classes apply.

Introduction

Application and Task

Application

You know the superposition of fields. Have the magnetic fields a superposition two?

Aufgabe

1. Measure the magnetic flux density along the two short 41mm \varnothing coils. The Coils having the same polarity.
2. Measure the magnetic flux density along the two short 41mm \varnothing coils. Change the polarity of one Coil.

Equipment

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Setup and Procedure

Setup

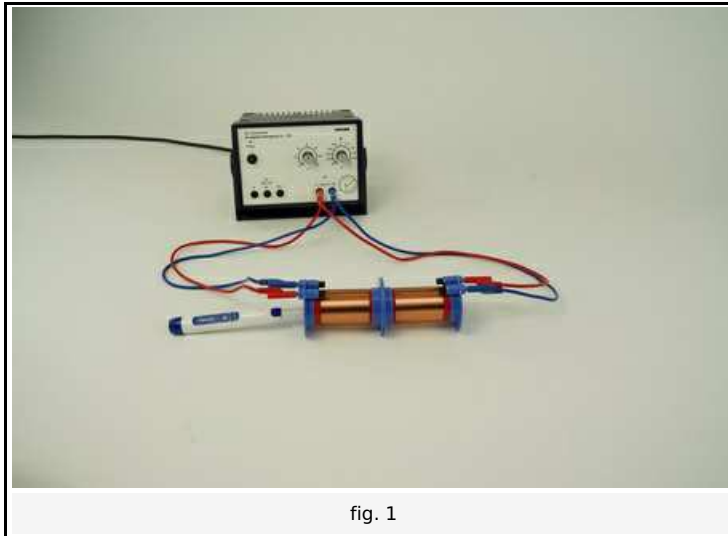


fig. 1



fig. 2

Build the experiment as shown in fig. 1. The coils are connected in parallel. Make sure the polarity is the same for both coils. The coil connections are each outside, so the winding of the two coils are opposite. Make sure, the current of the two coils having the same corkscrew direction. Connect your tablet to the Cobra SMARTsense magnetic field sensor. Select point by point measurement [Configuration-> Point by point measurement (fig. 2)].

Procedure

1. Insert the magnetic field sensor as far as possible through the two coils. Since the tip of the coil is not visible, you can use the ruler to determine the position to measure the magnetic flux density.
2. Turn on the power supply and set the amperage to $I = 1.2\text{A}$. Pull the magnetic field sensor in 1cm steps from the two coils and take each time a measurement point by pressing a button.
3. Turn off the power supply and replace the cable connections with one coil.
4. Switch on the power supply again and repeat task 1 and 2.