B Parallel Longitudinal Force

Horace Heffner April 20, 1996

BACKGROUND

There can be no *longitudinal* force on a charged particle due to movement through an orthogonal magnetic field. (The Lorentz force is a lateral force.) This conclusion is due to a simple experiment which has been done many times. That experiment is the placing of a non-superconducting ring between the poles of a C magnet orthogonally to the magnetic field, while the superconductor is warm. It is then cooled and removed from the field which induces a current in the ring, making it a magnet. If the subject force existed, it would either create a runaway current in the ring, or suppress the current. The current induced in the ring generates a magnetic field orthogonal to it's own motion, which would generate either a reinforcing or retarding longitudinal force upon charges in the current. In either case, an effect which has never observed should occur. Either there should be a runaway current (reinforcing force) or the superconduction should be immediately suppressed (retarding force). This does not happen. Therefore, if a longitudinal EM force exists, it is due to motion parallel to magnetic lines of flux. It is therefore of interest here to design an experiment to determine if such a force exists, and if it is of a magnitude such that simple practical devices can be built using such a force.

A TEST CONFIGURATION

Below is depicted a possible configuration for testing for a parallel magnetic field induced longitudinal force. A group of permanent magnets are arranged in a circle with their adjacent poles attracting. This is done to restrict the lines of flux to a nearly toroidal configuration. A coil of wire is formed (dimpled) over the top of the magnets and dips down into the gaps between the magnets so that much of the conductive path around the coil is parallel to the lines of flux. Call this a dimpled coil configuration (DCC).

Fig. 1 and Fig. 2 below are simplified drawings of a dimpled coil configuration.

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Fig. 1 - Top View of Dimpled Coil Configuration

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Fig. 2 - Side View Cross Section of Dimpled Coil Configuration

Note: in Figs. 1 and 2 the "dimples" over the magnets are repeated around the coil 4 times, x - denotes wire into page, o - denotes wire out of page. In Fig. 1 “NS” designates a repeat of the magnet-dimple configuration shown at the top of Fig. 1.

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If the coil is superconducting, there should quickly and spontaneously be a runaway current in the coil in the direction in which a longitudinal force is operative. This is due to existing thermal electron motion and local background EM fields. Even if the force is directionless with respect to B, a runaway should still occur as one local regime will overwhelm all others in its runaway current growth, thus building up a runaway velocity in some random direction. Any motion, even thermal motion, is reinforced by and generates a longitudinal force which then amplifies.

In a non-superconducting dimpled coil, there should be a slightly higher resistance in one direction than the other if the force is directional, i.e. dependent on the sign of B with respect to v, when they are parallel.

CONSTRUCTION OF THE TEST DEVICE

A DCC was fabricated to see if the suggested non-symmetric effect on the impedance of such a coil would be readily detectable at low voltages and currents. This was done using four 1" x 1" x 0.5" 35 MGO magnets, where B runs through the 0.5" thickness similar to the drawing above.

Four 0.5" thick 1" wide and 1" deep slots were milled into a 10" x 6" x 2" foam block to hold the magnets in place. The slots were positioned so the centers of the magnets (i.e. the magnetic field B) were aligned tangent to a 2 1/2" circle. A 1/4" wide groove was milled centered on the 2 1/2" circle connecting the magnets. The magnets were wrapped with electricians tape to prevent chips from flying in the case of an accidental attraction and to prevent the insulation of the fine wire coil from being cut. The magnets were inserted into the slots oriented so they were attracting, i.e. with opposing poles non-like, as in the drawing above.

A 50 turn coil of what appeared to be labeled no. 40 wire (it was measured to be .0032" thick including insulation) was wrapped on a 4" thermos cap. The cap had to be destroyed to get the wire off. The coil resistance was measured at 59.9 ohms. The wire coil was then laid over the magnets and pressed down into the circular groove between the magnets. The slack was shared equally in wire arches above each of the magnets. The wire in the grooves was then held in place by compressing very soft plastic foam "packing worms" into the grooves above the wire. Wire leads from the coil were then taken to 1 1/2" plastic machine screws screwed into the each side of the foam block. There at the machine screw and nut, they were soldered to some No. 22 bell wire, which was then run to an additional plastic machine screw for support to prevent motion in the vicinity of the fine wire joint. The two bell wire leads were then taken to a DPDT switch wired for fast lead reversal.

THE EXPERIMENT

The wire resistance was measured again. It was 60.0 ohms in either direction. The window had been closed a few minutes earlier so the difference in resistance was thought to be from a temperature increase. Warm air was blown over the DCC and the resistance jumped to 60.2 ohms.

Another 10" x 6" x 2" foam block was machined to accept the wire arches above the magnets and taped on top of the first block to prevent accidental tool attractions etc., and to stabilize the temperature.

The resistance remained 60.1 ohms in both directions, thus the results are negative.

A 1 kHz square wave was fed into the coil and the output square wave was unchanged from an input wave except for an approximately. 1 volt 1.25 MHz decaying oscillation at the leading edges visible for roughly 8 us.

A DC power supply was connected and varied from 3 to 25 V while monitoring both voltage and current for directional differences while toggling the DPDT switch to reverse current flow direction. No asymmetries were found. The output voltage was monitored by oscilloscope also. A waveform could be seen due to self induction from the coil field reversal, but no asymmetry was apparent.

SUMMARY OF RESULTS

The results of this test were negative as measured to better than 1 part in 300. If such a longitudinal force exists, it appears that it will only be found using superconducting coils or some completely different form of test using near light speed electrons.