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MEASUREMENT OF THE FLUX DENSITY BETWEEN MAGNETS IN ATTRACTIVE AND REPULSIVE MODE.

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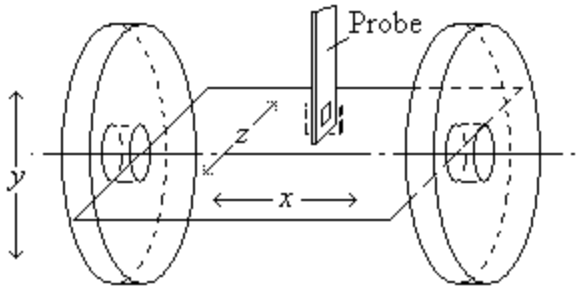
Force measured between permanent magnets or solenoid coils shows without exception repulsion weaker than attraction. This became the subject of our interest for some time (since its repeated appearance from 1973).
In correspondence with Galilean Electrodynamics in 2001 we suggested that if the attractive force between equal and unlike electric charges slightly exceeded the repulsive forces between equal and like electric charges, the difference could account for gravity. Assuming that the field of force between two magnets is related and in proportion to the density and geometry of the flux of magnetic field, to test further the asymmetry (mentioned above) we decided to perform precise measurements of B – density of the flux between two neodymium disc magnets. It was done in attractive and repulsive mode.



Measurement of the flux density - layout
(Probe shown parallel to the magnet surface)

Specifications:

- Instruments: Bell 640 Incremental Gauss Meter
  Probe: Model HTB4-0608, length 8.500”
- Magnets: 2 neodymium magnets – disc O.D. 1.520” (39mm) I.D. .2756” (7.14mm) magnetized across the thickness - .250” (6.35mm).
- Distance between magnets: 2.530” (65mm)
- Testing area in the central plane between magnets 2” (x) by 2.75”(z) in 1/8 increment in x and z axis.
- The minimal distance of magnets from a metal base 9.750”.
- The horizontal movement cross-slides – in x and z axis – one turn - 1/8”. For vertical (y) adjustment was used MELLES GRIOT vernier adjustable scissors jack.

Objectives and Description of the test:

- The objective was to measure an incremental density of the magnetic flux between two magnets when in attraction and repulsion. Also single magnet field was measured. Each measurement was made with the probe in parallel and perpendicular position relative to the magnet’s surface.
- The axis of magnets (x direction) was oriented in east – west direction, to minimize influence of the Earth’s magnetic field.
- The right side (from the operators view) magnet was always oriented with its north pole toward the west.
- The left side magnet was oriented as was required for the particular function: Like polarity toward the right side magnet for repulsion, and / or unlike polarity toward the right side magnet for attraction.
- The left side magnet was removed when the solo magnet flux was measured.

3D models of the flux density values were made to show the geometry of the flux distribution. The models were constructed to show also changes of polarity on the Hall effect sensor with change of direction of the flux.
However, as flux in all directions contributes to the distribution of the force between magnets, the absolute value(s) have to be taken to consideration, especially when calculating average values.

Results and discussion:

As was said earlier, we assume that the force experienced between two magnets is related and in proportion with the density of the flux of so called magnetizing field. The μ (magnetic permeability constant) in the equation of the force:

$$F = \frac{m_1 \; x \; m_2}{4\pi \, \mu \, d^2}$$

is actually the same μ as used in the flux equation: $\mu = 1 + 4\pi \, I/H$.*

For the final comparison we use averages of absolute values of all measurements:

Flux density in Gauss units.

- Attraction (Magnets oriented S – N) Sensor Parallel to Magnet Face.
  Average value: 6.502 Gauss
- Attraction (Magnets oriented S – N) Sensor Perpendicular to Magnet Face.
  Average value: 3.253 Gauss
- Repulsion (Magnets oriented N – N) Sensor Parallel to Magnet Face.
  Average value: 4.380 Gauss
- Repulsion (Magnets oriented N – N) Sensor Perpendicular to Magnet Face.
  Average value: 4.352 Gauss

We see that the total average value for attraction is 9.755 Gauss.
The total average value for repulsion is 8.732 Gauss.
The difference in flux density between attraction and repulsion between magnets in configuration as described above is 1.023 Gauss in favor of attraction.

Until now we are well aware of the difference between attractive and repulsive forces from experimentation with permanent magnets and electromagnets. Now – to our knowledge – for the first time we have measured numerical values of the field flux showing that indeed the flux density is distributed differently in the field of attraction and repulsion, having the flux of attraction field denser.

*MAGNETISM An Introductory Survey, E. W. LEE, Dover Publications, Inc. New York 1970. Page 56.