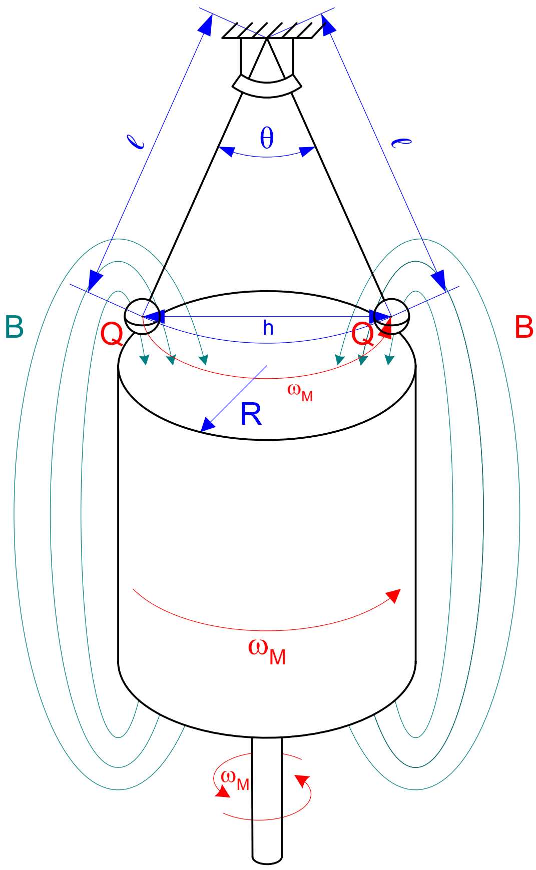
EXPERIMENTAL PROOFS OF M HYPOTHESIS

Solid experimental proofs of M hypothesis are shown on the following pictures.
Following picture depicts simple experimental setup able to confirm that rotating permanent homopolar magnet has motional magnetic field. The setup is consisted of homopolar magnet and two small charged balls previously charged with Van de Graaff[1] generator and hanged above homopolar magnet as it is shown on the following picture:

Fig. 1



The angle between charges is strongly affected by angular speed of permanent magnet regardless the magnet's conductivity. Anyway, this possibility can be excluded simply by calculation of the Magnet's electrostatic capacity. Lorentz's force that acts to those charges caused by the magnetic field's rotation of magnetic field is:

$$\vec{F} = Q \cdot \vec{v} \times \vec{B} = Q \cdot (\vec{\omega} \times \vec{r}) \times \vec{B} \tag{1}$$

Forces' composition acting to those charges is:

$$\vec{F}_{\vec{E}} \pm \vec{F}_{\vec{B}} - \vec{F}_{\vec{G}} = 0 \tag{2}$$

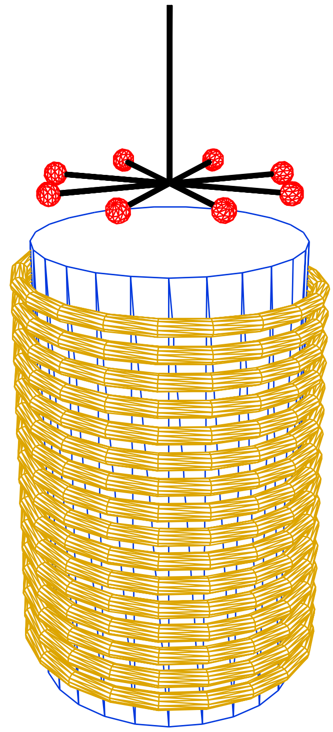
[1] Robert Jemison Van de Graaff, 1901–1967

Experimentally determined angle between filaments that carry charges almost perfectly matches following theoretical formula derived from (2):

$$\theta = \mathrm{ASIN}\left(\sqrt[3]{\frac{1}{16\cdot\pi\cdot\varepsilon\cdot(2\cdot Q\cdot\omega\cdot\ell\cdot B+m\cdot g)}\cdot\left(\frac{Q}{\ell}\right)^{2}}\right) \tag{3}$$

The fact that the charges are strongly affected by rotation of the magnet is ultimate proof that magnetic field rotates with the same velocity as its source. AC induction is shown on the following picture:

Fig. 2



Device is consisted of several balls charged with Van de Graaff electrostatic high-voltage generator, which are able to freely rotate and settled right above electromagnet. Whenever there is increase of the current in the coil there is also rotation of the charged balls settled above the magnet and the disk rotates in contra direction whenever there is decreasing of the current in the coil. If there would be appearance of pure electric field, than we would have force given by the formula:

$$\vec{F} = Q\cdot\vec{E} = Q\cdot\vec{v}\times\vec{B} \tag{4}$$

The velocity $\vec{v}$ could be found from general fields' string equation:

$$\frac{d\vec{B}}{dt} = \vec{\nabla}\times\left(\vec{v}\times\vec{B}\right) = \vec{v}\cdot\left(\vec{\nabla}\vec{B}\right) - \left(\vec{v}\cdot\vec{\nabla}\right)\cdot\vec{B} \tag{5}$$

The fact is that there are no free magnetons in space, thus above formula decays in the following form:

$$\frac{d\vec{B}}{dt} = -\left(\vec{v}\cdot\vec{\nabla}\right)\cdot\vec{B} \qquad (6)$$

According symmetry shown on fig. 2 and (6) we have the migration velocity represented in spherical coordinates is:

$$v_r = \frac{\frac{dB_z}{dt}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_z}{\partial z}\cdot\frac{dB_r}{dt}}{\frac{\partial B_z}{\partial r}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_r}{\partial r}\cdot\frac{\partial B_z}{\partial z}} \qquad (7)$$

And:

$$v_z = \frac{\frac{\partial B_z}{\partial r}\cdot\frac{dB_r}{dt} - \frac{dB_z}{dt}\cdot\frac{\partial B_r}{\partial r}}{\frac{\partial B_z}{\partial r}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_r}{\partial r}\cdot\frac{\partial B_z}{\partial z}} \qquad (8)$$

Or, vector of migration's velocity of magnetic field for the particular axe symmetric case is:

$$\vec{v}_{\vec{B}} = \begin{bmatrix} \frac{\frac{dB_z}{dt}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_z}{\partial z}\cdot\frac{dB_r}{dt}}{\frac{\partial B_z}{\partial r}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_r}{\partial r}\cdot\frac{\partial B_z}{\partial z}} & 0 & \frac{\frac{\partial B_z}{\partial r}\cdot\frac{dB_r}{dt} - \frac{dB_z}{dt}\cdot\frac{\partial B_r}{\partial r}}{\frac{\partial B_z}{\partial r}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_r}{\partial r}\cdot\frac{\partial B_z}{\partial z}} \end{bmatrix} \qquad (9)$$

So, we have following equation of the force acting on charged balls depicted on fig. 2:

$$\vec{F} = Q\cdot\left(\vec{v}_{\vec{B}} - \vec{v}_Q\right)\times\vec{B} \qquad (10)$$

$\Rightarrow$

$$\vec{F} = Q\cdot\left(\begin{bmatrix} 0 & B_r\cdot\frac{\frac{\partial B_z}{\partial r}\cdot\frac{dB_r}{dt} - \frac{dB_z}{dt}\cdot\frac{\partial B_r}{\partial r}}{\frac{\partial B_z}{\partial r}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_r}{\partial r}\cdot\frac{\partial B_z}{\partial z}} - B_z\cdot\frac{\frac{dB_z}{dt}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_z}{\partial z}\cdot\frac{dB_r}{dt}}{\frac{\partial B_z}{\partial r}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_r}{\partial r}\cdot\frac{\partial B_z}{\partial z}} & 0 \end{bmatrix} - \vec{v}_Q\times\vec{B}\right) \qquad (11)$$

Or:

$$\vec{F} = Q\cdot\left(\left(B_r\cdot\frac{\frac{\partial B_z}{\partial r}\cdot\frac{dB_r}{dt} - \frac{dB_z}{dt}\cdot\frac{\partial B_r}{\partial r}}{\frac{\partial B_z}{\partial r}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_r}{\partial r}\cdot\frac{\partial B_z}{\partial z}} - B_z\cdot\frac{\frac{dB_z}{dt}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_z}{\partial z}\cdot\frac{dB_r}{dt}}{\frac{\partial B_z}{\partial r}\cdot\frac{\partial B_r}{\partial z} - \frac{\partial B_r}{\partial r}\cdot\frac{\partial B_z}{\partial z}}\right)\cdot\hat{i}_\phi - \vec{v}_Q\times\vec{B}\right) \qquad (12)$$

Whereas magnetic field of a single circular current loop is:

(13)

$$B_r = \frac{\mu \cdot I}{2 \cdot \pi} \cdot \frac{r}{z} \cdot \frac{\frac{R^2 + z^2 + r^2}{z^2 + (r-R)^2} \cdot \mathrm{EllipticE}\left(2 \cdot \sqrt{\frac{r \cdot R}{z^2 + (r+R)^2}}\right) - \mathrm{EllipticK}\left(2 \cdot \sqrt{\frac{r \cdot R}{z^2 + (r+R)^2}}\right)}{\sqrt{z^2 + (r+R)^2}}$$

And:

(14)

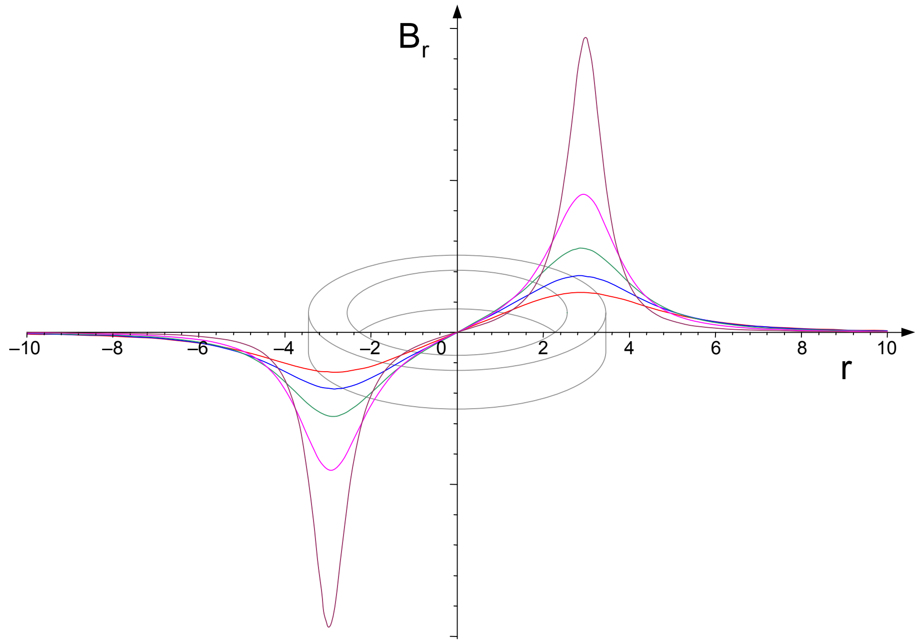
$$B_z = \frac{\mu \cdot I}{2 \cdot \pi} \cdot \frac{\frac{R^2 - z^2 - r^2}{z^2 + (r-R)^2} \cdot \mathrm{EllipticE}\left(2 \cdot \sqrt{\frac{r \cdot R}{z^2 + (r+R)^2}}\right) + \mathrm{EllipticK}\left(2 \cdot \sqrt{\frac{r \cdot R}{z^2 + (r+R)^2}}\right)}{\sqrt{z^2 + (r+R)^2}}$$

Variables are:

- R = radius of stator coil's loop of left motor on fig. 1,
- I = electric current trough loop,
- z = altitude over the loop's plane,
- r = distance from the axe of symmetry, i.e. from the center of a stator coil.

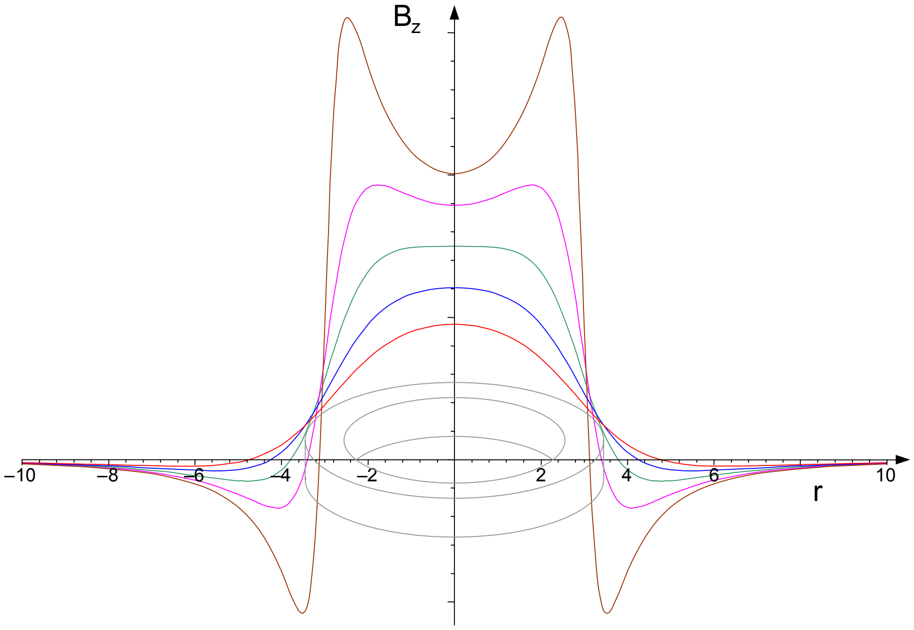
Graphic of B_r of a single loop ($r = 3$, $z \in$ [0.5, 1, 1.5, 2, 2.5]):

Fig. 3



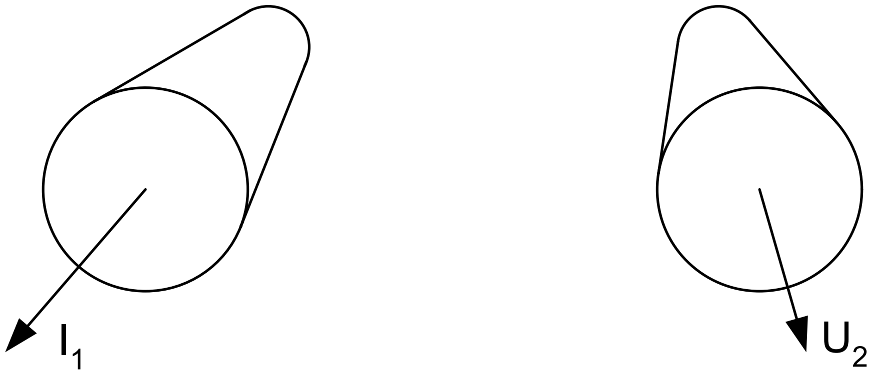
Graphic of B_z of the loop is ($r = 3$, $z \in [0.5, 1, 1.5, 2, 2.5]$):

Fig. 4



Equation (12) shows that speed of charges hanged above solenoid cannot surpass speed of magnetic field pushing them and defined with (9).
M hypothesis can be check on a simple case of AC induction from an AC conductor to another one:

Fig. 5



While there are two infinite conductors, there is no closed contour and classic Faraday's induction formula cannot be applied. We have following equation of magnetic field in cylindrical coordinate system:

$$\vec{B} = -\frac{\mu \cdot I}{4 \cdot \pi} \cdot \oint_{\ell} \frac{d\vec{\ell} \times \hat{r}}{\vec{r}^2} = -\frac{\mu \cdot I}{2 \cdot \pi \cdot r} \cdot \hat{i}_\phi \tag{15}$$

Composition of equations (5) and (15) is:

$$\vec{\nabla} \times \left(\vec{v} \times \vec{B}\right) = -\frac{\mu}{2 \cdot \pi \cdot r} \cdot \frac{dI}{dt} \cdot \hat{i}_\phi \tag{16}$$

Full conversion of above equation into cylindrical coordinates is:

$$-\frac{\partial}{\partial r}\left(\left(\left(v\cdot\hat{i}_r\right)\times\left(-\frac{\mu\cdot I}{2\cdot\pi\cdot r}\cdot\hat{i}_\phi\right)\right)\cdot\hat{i}_\ell\right)\cdot\hat{i}_\phi=-\frac{\mu}{2\cdot\pi\cdot r}\cdot\frac{dI}{dt}\cdot\hat{i}_\phi \qquad (17)$$

$\Rightarrow$

$$\frac{I\cdot v}{r}=\frac{dI}{dt} \qquad (18)$$

We can find now migration speed of magnetic field of straight infinite conductor with AC current:

$$\vec{v}=\frac{r}{I}\cdot\frac{dI}{dt}\cdot\hat{i}_r \qquad (19)$$

It is interesting to be noticed that the migration velocity can be superluminal too.
We can insert above formula into (4) and then we have:

$$\vec{E}=\vec{v}\times\vec{B}=\left(\frac{r}{I}\cdot\frac{dI}{dt}\right)\cdot\left(-\frac{\mu\cdot I}{2\cdot\pi\cdot r}\right)\cdot\left(\hat{i}_r\times\hat{i}_\phi\right)=\frac{\mu}{2\cdot\pi}\cdot\frac{dI}{dt}\cdot\hat{i}_\ell=\frac{\mu}{2\cdot\pi}\cdot\frac{dQ}{dt}\cdot a\cdot\hat{i}_\ell \qquad (20)$$

Induced electric field is collinear with the conductor just as it is case with transformer and the polarity matches the transformer's reality.
If the conductors are long enough to be approximated with infinite parallel conductors, then we have that potential is proportional to length of the conductors:

$$V=\vec{E}\cdot\vec{\ell}=\frac{\mu\cdot\ell}{2\cdot\pi}\cdot\frac{dI}{dt} \qquad (21)$$

This unique ability to yield correct AC induction's formula based on magnetic field's migration (19) is clear proof of the correctness of M hypothesis.

Author:
Andrija Radović
andrija_radovic@hotmail.com