

A magnetic Rotor to convert vacuum-energy into mechanical energy

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Abstract

In previous work it was demonstrated, how vacuum-energy can be made manifest in the laboratory and how it can be practically converted into mechanical energy with the use of electrostatic forces driving a rotor using the energy of an electrostatic field.

In analogy to this electrostatic principle, the energy of a magnetic field allows an alternative method to convert vacuum-energy into mechanical energy. A design of an experiment to realize this conversion is conceived here. The calculation of the forces and torques of an exemplary rotor leads to the expectation that a magnetically driven rotor can be built of the movement should be observable.

Article body

Physical background

In [1] the author demonstrated that electrostatic charge permanently emits electric field of which the energy density and thus the energy can be calculated from the emitted field strength. This is the case, even if the charge is in contact with nothing else but only the empty space, namely the vacuum. This means that the charge as a source of the field is permanently supplied with energy from the space. The connection of this phenomenon with the conservation of energy can be recognized by tracing the field during its propagation through the space. Thereby it was found, that the space itself re-absorbs some of the energy from the field during its propagation.

In order to prove the existence of this perpetual cycle of energy through the vacuum, an experiment was conceived in [2] and performed successfully, which interacts with this energy cycle, extracts energy from this cycle and converts it into mechanical energy in order to make it visible in the laboratory. The fact that this experimental conversion of energy was successful, demonstrates the suitability of the conceptual understanding of the said cycle of energy in the vacuum.

In [3] it was found by theoretical calculation that the energy cycle of the emission of energy in the field source and the re-absorption of energy by the space (the vacuum) during the propagation of the field, does not only appear with the electrostatic field but also with the magnetic field. Consequently it should be expected, that in analogy to the electrostatic rotor converting vacuum-energy into mechanical energy via electrostatic energy, the development of a magnetic rotor should be also possible, which converts vacuum-energy via the energy of a magnetic field into mechanical energy. How such an experiment can be planned is subject of the further course of this article here.

Theoretical basics

The rotation of the electrostatic rotor had been explained by considering the forces acting onto the rotor-blades made of electrically conducting material with the use of the image-charge

method [4]. One central fundament for the applicability of this method is the fact, that the electric flux coming from outside onto the surface of the material rearranges the electrical charge distribution on the surface in such a way, that the flux-lines are always exactly perpendicular to the conducting surface [5]. The force between the charge and the image-charge explains the rotation of the rotor-blades and thus it proves the cycle of energy between electrostatic energy and vacuum-energy.

If this principle of energy conversion shall be adopted to the energy cycle between magnetic energy and vacuum-energy, a rotor driven by magnetic forces should be possible, which can be understood in analogy to the rotor driven by electrostatic forces. This analogon is to be found in the Meissner-Ochsenfeld-effect occurring on the surface of a superconductor in a magnetic field [6]. Similar as the image-charge method is based on the appearance of electrostatic charges on the surface, the Meissner-Ochsenfeld-effect is based on the appearance of superconducting currents on the surface of a superconductor in a magnetic field. These currents evoke magnetic fields, which exactly compensate the external magnetic field, so that in the inside of the superconductor the total magnetic field is zero. In this sense, superconductor displays ideal diamagnetic behavior with $\chi = -1$ (see [7]).

In order to calculate the forces which superconducting rotor-blades take up in a magnetic field, the field strength at each point on the surface of the rotor-blades have to be taken into account and their interaction with the field strength of the same absolute value but of the opposite orientation has to be determined. An exemplary setup of an imaginable rotor is show in fig.1 with a permanent magnet in the above part of the sketch and a rotor consisting of four superconducting blades in the bottom part of the sketch. The physical dimensions noted there serve as input parameters of an exemplary calculation which has the purpose to give a feeling of concretely achievable forces and torques. The forces are repulsive (not attractive), because the flux-lines can not penetrate into the ideal diamagnetic material. This is generally known from the Meissner-Ochsenfeld-effect, and it is independent from the polarity of the flat permanent magnet above the rotor. Thus the direction of the rotation of the rotor in fig.1 is counterclockwise (other than the electrostatic rotor in [2]).

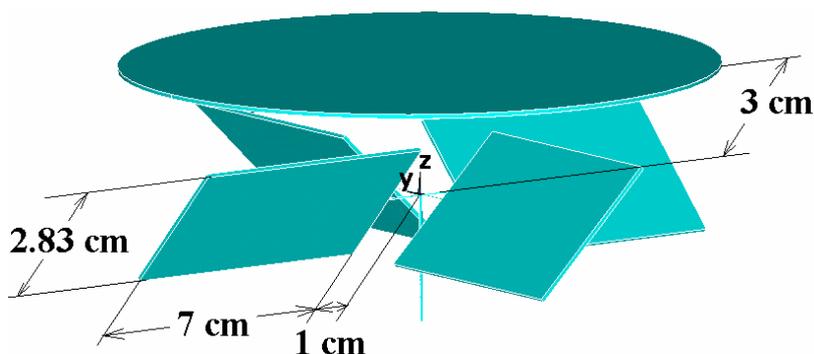


Fig.1: Graphical visualization of a superconducting rotor, which is mounted on an axis below a flat permanent magnet.

Calculation of a numerical example

For the sake of simplicity of a numerical example, the external magnetic field driving the rotor shall be premised to be homogeneous (with a numerical value of $|\vec{H}| = 1 \frac{A}{m}$), and it shall be orientated along the z-axis. Thus the vector of the magnetic field is the same on all positions on the surface of the rotor-blades. Consequently the magnetic field produced by the Meissner-Ochsenfeld-effect (which compensates the external field) is orientated exactly into the negative z-axis for all positions of the rotor-blades (and has the absolute value of $|\vec{H}| = 1 \frac{A}{m}$). But the position-vectors from all individual points of the field source to all individual points on the surface of the rotor-blades are going into individually different directions. And each rotor-blade is not symmetric with regard to the z-axis. Consequently the total force acting onto each

rotor-blade, which is the sum of all forces acting onto each individual part of the rotor-blade contains a tangential component which is not orientated into the z-direction. This consideration implies a subdivision of the field source and the rotor-blade into finite elements.

For the calculation of this force, Biot-Savart's law (regarding the field of the field source, index no.1) is dissolved to the magnetic field as well as the Lorentz force onto a moving charge (index no.2) within the field of the charge no.1. By this means the force of the interaction of two field strengths (H_1 and H_2) can be calculated according to the equation

$$\vec{F}_{12} = 4\pi\mu_0 \cdot |\vec{r}_{12}|^2 \cdot (\vec{e}_{12} \times \vec{H}_1) \times \vec{H}_2 ,$$

with $\mu_0 = 4\pi \cdot 10^{-7} \frac{Vs}{Am}$, \vec{r}_{12} = vector from the field source to the rotor blade

\vec{e}_{12} = unit vector from the field source to the rotor blade.

Because the field strength has been chosen to be homogeneous in our example ($H_1 = -H_2 = 1 \frac{A}{m}$), the total force onto a rotor-blade can be determined by a rather simple integration over the surfaces of the field source and the blade. For the given example, this was carried out by a subdivision of the blade as well as the field source into finite elements. The result on the basis of the given numerical parameters is $F_R = 4.2 \cdot 10^{-8} N$ for the radial component of the force and $F_T = 3.1 \cdot 10^{-10} N$ for the tangential component of the force per each single rotor blade. The radial component of the force is compensated by the mechanical axis of the rotor, whereas the tangential component of the force makes the rotor spin. A rotor consisting of four blades takes up four times the tangential force, this is $F_T = 1.2 \cdot 10^{-9} N$.

The torque onto the rotor was calculated by summing up the torque of each finite element of the rotor with its individual radius of rotation, which leads to the result of $M = 4.8 \cdot 10^{-11} Nm$.

This value is too small for an experimental verification, but the field strength can be enhanced remarkably and with it, the forces and the torque increase quadratically, according to the proportionality of the absolute values $|\vec{M}| \sim |\vec{H}_2| \cdot |\vec{H}_1|$. The limit of the field strength is given by the critical field strength B_c of the Meissner-Ochsenfeld-effect, which depends on the temperature. For instance Pb has $B_c = 0.080T$ and Al has $B_c = 0.01T$ (with temperature extrapolated $T \rightarrow 0K$), which are examples of superconductors type 1. In order to have some safety distance from the critical field, and in order to respect the fact the temperature in a real experiment is different from zero, we can allow a magnetic induction of few milli Tesla, corresponding with a field strength of about $H_1 \approx 10^3 \frac{A}{m}$. This lets us expect a the tangential component of the force in the order of magnitude of $F_T \approx 10^{-9} \cdot 10^6 N \approx 10^{-3} N$, providing a torque of about $M \approx 5 \cdot 10^{-5} Nm$. This should be sufficient for a measurement.

If cooling should be made as easy as possible by using liquid nitrogen, it could be interesting to work with a high-temperature superconductor, as for instance $YBa_2Cu_3O_7$, which is known to be a superconductor type 2. It only behaves ideal diamagnetic as long as the Shubnikov-phase is avoided. Nevertheless the field strength and with it the maximum reachable forces and the torque should be expected to be larger than with the superconductor type 1 as mentioned above.

Continuative remarks regarding an experiment

Another question is, whether the practical performance of the experiment really needs ideal diamagnetic rotor-blades made from superconductor material. Also conventional dia-, para-, and ferro- magnetic materials experience forces when they are exposed to magnetic fields.

If a rotor would be made from diamagnetic metal (at room temperature), for instance such as copper ($\chi = -1 \cdot 10^{-5}$) or bismuth ($\chi = -1.5 \cdot 10^{-4}$) (see [8]), it would be $H_2 = -\chi \cdot H_1$. With the

same strength of the external field, the forces and the torque would be about 4 or 5 orders of magnitude smaller compared to a superconducting rotor, but the field strength could be enhanced perhaps to 1 Tesla or even more rather easily, so that finally the torque might be enhanced to a value even a bit larger than with a superconducting rotor.

Instead of using a diamagnetic rotor, it might be discussed to build up a paramagnetic rotor, for instance of platinum ($\chi = +1.9 \cdot 10^{-6}$) or aluminium ($\chi = +2.5 \cdot 10^{-4}$) (see [9]). The forces will be attractive in this case so that the rotor spins with opposite direction than a diamagnetic rotor, but the absolute values of the torque should be of the same order of magnitude as those of diamagnetic rotor.

Large forces might be expected from a ferromagnetic rotor. If it would be sensible to ascribe a susceptibility to ferromagnetic materials, this would lead to values several orders of magnitude larger the susceptibility of dia- or paramagnetic materials. But ferromagnetic materials produce a magnetization because of a regularity of the electron spins, which depends on the previous history of the material [10]. Thus it is very doubtful whether it is allowed to carry forward our theoretical considerations to ferromagnetic materials. The image-charge method had been applied to the electrostatic rotor, and its analogon was developed for an ideal diamagnetic surface. Consequently it is not clear, whether these considerations are sufficient for dia-, para, or ferromagnetic materials. All the more we face this question regarding ferromagnetic rotor-blades because ferromagnetic domains should be generated and kept in the material because of the Barkhausen-effect. This arises serious doubts, whether the spins and magnetic moments can follow an external magnetic field as it is required for a rotor which converts vacuum-energy into magnetic and mechanical energy.

Furthermore, for the practical construction of a magnetic rotor, it should be kept in mind, that the above calculation came to the result, that the tangential component of the force (causing the rotation) is about two orders of magnitude larger than the radial component of the force (disturbing the rotation). Thus it is essential to build up the mechanical arrangement of the components with extremely high precision in order to avoid that the radial forces will prevent the rotation. Deviations from the ideal exact movement of the rotor have to be kept such small, that the rotor will not find a minimum of energy at some position, which stops its rotation. Forces keeping the rotor in the position of an energy minimum because of tolerances in the mechanical setup have to be smaller than the driving radial forces. This problem of a rotor being stopped in a minimum of energy regarding the tangential force was already practically experienced by the author, and this is why he does not claim that the magnetic rotor was already rotating in an experiment. One or two revolutions with problems in reproducibility have been observed, and this is not a successful rotation. The experiment still has to be done.

The spinning of the electrostatic rotor is already experimentally verified. From time to time, there was an occasional discussion of electrohydrodynamic effects disturbing rotation of the electrostatic rotor. This problem can not occur at the magnetic rotor by principle, because up to now magnetohydrodynamic effects are not known at all. From this point of view, it would be desirable to get the magnetic conversion of vacuum-energy experimentally confirmed.

Resumée

The considerations of this article arise the expectation, that it should be possible to convert vacuum-energy not only via electrostatic energy but also via magnetic energy into mechanical energy. The experiment is a serious challenge, but the theoretical expectations are formulated in the preceding article, and they give hope, that this conversion of vacuum-energy might

really work. Besides, a net gain of energy would be rather easy within reach for the magnetic rotor, because the magnetic field source can be a permanent magnet.

By the way, the author tried to supply the electric field for an electrostatic rotor with a remanent polarized electret, but this was not sufficient to make the electrostatic rotor rotate, probably because the surface charge density of the electret was too inhomogeneous to give rise to proper spinning of the rotor. Only two or three revolutions have been maximally observed, which is not enough to claim, that electrostatic rotor was already driven experimentally with the electric field of an electret.

References

- [1] Two Paradoxes of the Existence of electric Charge (Okt.2007)
Claus W. Turtur, arXiv:physics/0710.3253 v1
- [2] Conversion of vacuum-energy into mechanical energy: Successful experimental Verification
Claus W. Turtur, PHILICA.COM, ISSN 1751-3030, Article number 124, (2. April 2008)
- [3] Two Paradoxes of the Existence of magnetic Fields
Claus W. Turtur, PHILICA.COM, ISSN 1751-3030, Article number 113, (Dec. 2007)
- [4] Theorie der Elektrizität, R. Becker and F. Sauter (1973).
Teubner-Verlag, ISBN 3-519-23006-2
- [5] Klassische Elektrodynamik (1981)
John David Jackson, Walter de Gruyter Verlag, ISBN 3-11-007415-X
- [6] Moderne Physik, P. A. Tipler and R. A. Llewellyn (2003)
Oldenbourg Verlag, ISBN 3-486-25564-9
- [7] Bergmann-Schäfer Lehrbuch der Experimentalphysik, Band 6, Festkörper (2005)
Rainer Kassing et. al., Walter de Gruyter Verlag, , ISBN 3-11-017485-5
- [8] Taschenbuch der Physik, H. Stöcker et. al. (2007)
Verlag Harri Deutsch, ISBN 978-3-8171-1720-8
- [9] Gerthsen Physik, H. Vogel (1995)
Springer Verlag, ISBN 3-540-59278-4
- [10] Ferromagnetismus, E. Kneller (1962)
Springer Verlag, Library of Congress Catalog Card Number 62-17383

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