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Magnetic Monopoles and a Short Remark on J. J. Thomson Magnetic Monopole Solution

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Abstract

Magnetic monopole is the one of the most interesting concepts/objects in physics. According to Maxwell equations it can not exist by $\nabla . B = 0$ equation. At the same time according to Glashow Salam Weinberg electroweak theory it must exist, and Dirac states its existence for the mathematical elegance of Maxwell equations, and to explain the charge quantization it is used. Until now many theoretical solutions were studied and derived. At 1904 Joseph John Thomson studied a theoretical solution on a physical system consisting of a charge q and a magnetic monopole g. Here the physical and mathematical validity of this solution will be discussed.

Keywords: Magnetic Monopole

Introduction

Maxwell equations so successfully unified electricity and magnetism and explained all electromagnetic events. For years the existence and the necessity of magnetic monopole always were discussed and searched. There is a very rich literature, very important brilliant physicists and mathematician such as J. J. Thomson, Dirac, Witten etc. studied well. There is a debate also. According to Maxwell Equations it must not exist by $\nabla . B = 0$. But on the other hand according to Glashow Salam Weinberg electro weak theory and in order to explain the charge quantization it must exist [1-8].

J. J. Thomson Magnetic monopole g and charge q system solution

At 1904 J. J. Thomson studied a static physical system consisting of a magnetic monopole g and a charge q. There is a distance R between them.

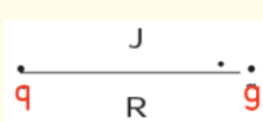

Figure 1: A static electric charge q and a static magnetic monopole g.

Electric lines $\vec{E}$ come from charge q and magnetic lines $\vec{B}$ come from magnetic monopole g. From here Thomson derived a circular $\vec{S} = \vec{E} \times \vec{B}$ vector by using the cross multiplication and found out angular momentum by integrating the moment of the momentum density of scalar fields:

$$\vec{J} = \int (dr) r \times G = \int (dr) r \times \frac{\vec{E} \times \vec{B}}{4\pi c}$$

$$= \frac{1}{4\pi c}\int (dr) r \times \left[\frac{qr}{r^3} \times \frac{g(r-R)}{(r-R)^3}\right] = \frac{qg}{c}\hat{R} \qquad \text{...........(1)}$$

But here there are some contradictions. Basically the vector multiplication of an electric field coming from an independent charge q and a magnetic field $\vec{B}$ coming from an independent charge g does not result in an $\vec{S} = \vec{E} \times \vec{B}$. Maxwell equations or electromagnetism states that electromagnetic field is composed of three perpendicular vectors; an electric field vector $\vec{E}$, a magnetic field vector $\vec{B}$ and $\vec{S} = \vec{E} \times \vec{B}$ vector. But it does not state the reverse; when they meet totally apart independent a magnetic field $\vec{B}$ and totally independent an electric field $\vec{E}$ they do not result in $\vec{S} = \vec{E} \times \vec{B}$.

Secondly if one imposes strictly perpendicular meeting between magnetic and electric fields it is possible between them to draw a curve for upper and lower part at each point they meet perpendicularly. If this condition is neglected it is also possible beyond the charges to define $\vec{S} = \vec{E} \times \vec{B}$ vectors. But each cases this not valid physically.

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