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Electrostatics in 2niverse

1. There exist three different kinds of fundamental charges in our universe.

    - If three **small** electrically charged bodies, A, B and C, exhibit pairwise mutual attraction, and, if both A and B attract a fourth electrically charged body, D, then we **always** find that C repels D.

2. Charge is **quantized**, i.e., every isolatable charge q has a magnitude **ne**, where $e = 1.6 \times 10^{-19}\ C$, and $n \in N$.

3. If we have a system of charges of equal magnitudes of each of the three fundamental types, then, another charge q (irrespective of type), positioned from our system far enough that the separations between the charges in our system is negligible, will neither be attracted nor be repelled by our system. As usual, this kind of electrically neutral system is obtained when we combine equal magnitudes of each of the three fundamental types of charges, which results in the charges "cancelling each other out", that is, if **a, v,** and **d** denote the three types of charges, then, the following identities must be satisfied:

$$|a + v + d| = 0.$$

$$|a| = |v| = |d| = 1.$$

The second condition indicates that a, b, and c are the position vectors of three distinct points on the unit circle. The simplest solution seems to be the cube roots of unity, so, let -

$$\vec{a} = (1,\ 0),\ \vec{v} = \left(-\tfrac{1}{2},\ +\tfrac{\sqrt{3}}{2}\right),\ and\ d = \left(-\tfrac{1}{2},\ -\tfrac{\sqrt{3}}{2}\right).$$

Given that these exist, it would follow that their pairwise combinations exist as well, given by:

$$-\vec{a} = \vec{v} + d = (-1,\ 0).$$

$$-\vec{v} = \vec{a} + \vec{d} = \left(\tfrac{1}{2},\ -\tfrac{\sqrt{3}}{2}\right).$$

$$-\vec{d} = \vec{a} + \vec{v} = \left(\tfrac{1}{2},\ \tfrac{\sqrt{3}}{2}\right).$$

4. Charges are now vector quantities. However, there only exist six unit charges and any charge q would have to be ne times any one of them.
5. Therefore, the proton (henceforth denoted by **p**^{g}) is a particle with a charge ea, and the antiproton is a particle with charge $e-a$.

   Henceforth, let the particles with charges ev and $e\vec{d}$ be known as the **cion** (henceforth denoted by **c**^{m}) and **vuon** (henceforth denoted by **v**^{t}), respectively. The **anticion** and the **antivuon** are particles with charges $e-v$ and $e-d$.
6. <u>Electrostatic Force</u>
   a. Consider the two point charges, q_1 at $\vec{r_1}$ and q_2 at $\vec{r_2}$. The magnitude of the force F_{12} exerted by q_1 on q_2 is still subject to Coulomb's Law:

   $$|\vec{F}_{12}| = \frac{|q_1|*|q_2|}{4\pi\varepsilon_0\left|\vec{r_2}-\vec{r_1}\right|^2}$$

   b. The sign of F_{12} (whether it is parallel or antiparallel to $\hat{r}_{12}$), can be obtained from the table below, using the charge types of q_1 and q_2 (+ for repulsion, - for attraction, 0 for 0 net electrostatic force):

Charge Type	a	$\vec{v}$	d	$-a$	-v	-d
$\vec{a}$	+	-	-	-	0	0

$\vec{v}$	-	+	-	0	-	0
d	-	-	+	0	0	-
$-a$	-	0	0	+	-	-
$-v$	0	-	0	-	+	-
$-d$	0	0	-	-	-	+

c. The zeroes in the above table reveal an interesting twist in the tale of charges. It is now possible to have a system consisting of two static charges in each other's neighbourhoods but with 0 net electrostatic potential energy!

d. The reason zeroes exist in the above table becomes evident when you consider the example of an interaction between a $a(=\vec{v}+\vec{d})$ type charge and an $\vec{m}$ type charge. Think about the -a charge as an m and t type charge in the same location. So, the -a charge would equally attract and repel the m type test charge, i.e., exert no net force on it.

e. The anticipation of the magnetic field and its orientation was something that we found peculiar. Different assumptions about the conditional setup of the experiment will lead to different results and we think of normalising those possibilities as of now.

   Also we need to perceive about how the cions and vuons will interact and affect their milieu environment, of which below is an anticipated attempt : -

The attempt we made in understanding the problem in a strong magnetic field.

Let's assume that in the presence of a strong magnetic field 'B' , the three particles are **charged**.

e_j denotes the charge on the jth particle.

The strong magnetic field induces a circular motion on the system
So for the 'j' th particle (j can be 1 , 2 or 3 to denote the electron, proton and the cion respectively).
The radius is given by

$$r_j \quad = m_j v_j / (e_j * B)$$

Since the magnetic field is assumed to be sufficiently strong, r_j <<<< in relation to the other length scales of the problem.

Let a_j be the position vector of the jth particle.
Let p_j be the momentum vector of the jth particle
So $a_{j,y}$ is the yth component of the position vector of the jth particle.

So the Hamiltonian of the system can be described as follows.

$H(a_{j\,,}\, p_j) = \Sigma_{j=1}^{3}\ 1/2m_j[(p_{j,x} - eB*a_{j,y})^2 \ + p_{j,2}^{\ 2}\ ] \ + V(\ a_1, a_2, a_3)$
---------------->**Equation (1)**

We can further find the **Hamiltonians** of the **orbital** and **Spin angular momenta**

$x=(x_1, x_2, x_3)$
$y=(y_1,y_2,y_3)$

So the Translation(s) about x axis can be written as
$T_y= \Sigma^{\,j=3}{}_{j=1}\ x_j$ where we know j=1,2,3

Similarly
$T_x = \Sigma^{\,j=3}{}_{j=1}\ y_j$

Let J denote the rotations about the origin,

$J= \frac{1}{2}\ \Sigma^{\,j=3}{}_{j=1}(x_j^{\ 2} + y_j^{\ 2})$ ---------------->**Equation (2)**

The orbital angular momentum can be written as

$L = \frac{1}{6} (T_x^2 + T_y^2)$

The Spin angular momentum can be written as **S=J-L ---------------->Equation (3)**

The three equations show us that the system is integrable (a case of three particles in two dimensions)

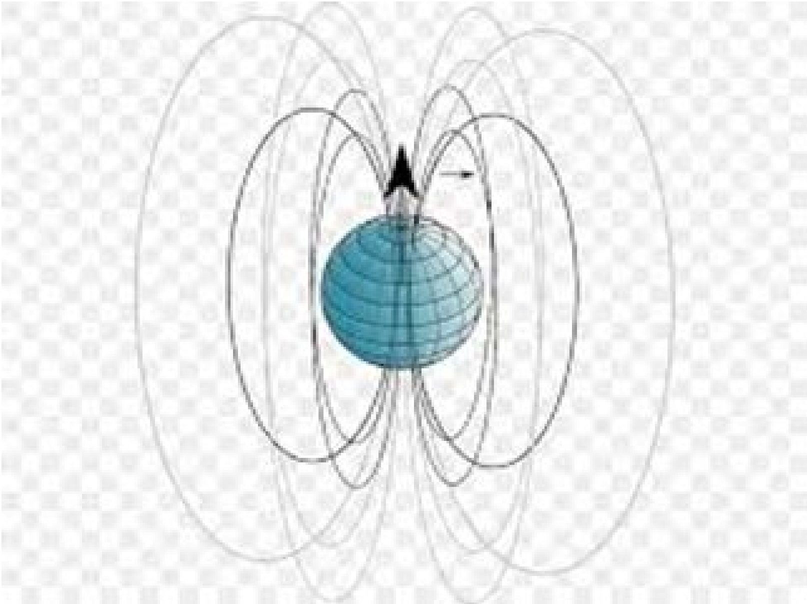
Below is a thought experiment to understand the magnetic interaction of coins and vuons -

MAGNETIC INTERACTIONS OF CIONS AND VUONS

The main idea that's put forth here is to show how cions and vuons interact with their milieu environment and with the magnetic field produced by the metallic solid spherical ball, with context to a dynamo kind of interior mechanism (with cions circulating inside it just like a stream of cion plasma which creates its own magnetic field and also the outer atoms of our gyroball are made such that they react with any cions in the vicinity), just like our Earth – call it the gyroball.

Now first of all they're considered to be inside an electron and now we will be colliding the electron with positron so as to annihilate the larger entity and so that the smaller cions and vuons are now in the surrounding space.

So now we take two important experimental framework where we subdue Ionised Oxygen-Neon into the room and on the other part, we impart the gyroball also into action. Now here the ionised Oxygen-Neon is contemporarily present so as to detect the vuons which do not interact with the magnetic field produced by our gyroball. Vuons here will interact with the highly ionised Oxygen-Neon gas mixture which will cause them to give off some luminescence. At the very moment the gyrosphere setup will be turned on which will impart/subdue the cions magnetic fields, which will be enveloping our gyrosphere in a way like that mentioned here –



Now the free cions that are left in the milieu environment interact with the gyroball's field lines and that produces a glow effect which we'll be able to see on the upper and lowermost portion of the gyroball just as the phenomenon of Aurora borealis on Earth. The cions instantly interact with the magnetic field lines and under their influence travel along the curved path upto the poles position they settle on the surface producing the Borealis whose shape and pattern may be given by the

Lorentz force -> ***F= q(E+v*B)*** where q is the charge of cions, v is incoming cions' velocity and E and B are the electric and magnetic field that are generated by the cions inside the gyrosphere.

References :

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