Re: Since k varies but not G suggests an Eather

Source: http://sci.tech−archive.net/Archive/sci.physics.relativity/2006−06/msg01457.html

- *From*: "Randy Poe" <poespam−trap@xxxxxxxxx>
- *Date*: 19 Jun 2006 08:44:45 −0700

guskz@xxxxxxxxxxx wrote:

> Randy Poe wrote:
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> > guskz@xxxxxxxxxxx wrote:
> >
> > > Well according to Randy in another thread k in F= k Qq/r^2
> > > remains the
> > > constant permittivity of space
> >
> > Yes.
>
> Your words from another thread:
>
> " The electrostatic force felt by a particle q in a medium....using the
> standard, unchanging value of k."

Yes.

> But the link below specifies that "k" does vary with the medium for
> ELECTROSTATIC FIELDS?:
>
> http://www.plus2physics.com/electrostatics/study_material.asp?chapter=2
>
> Electrostatic field: (The electric field stength is E= k Qq/r^2)
>
> Quote:
> "Lines of force are a convenient way of visualizing an electric field
> .....The total number of lines of force is
> inversely proportional to the ***PERMITTIVITY(thus k) OF THE MEDIUM****
> in which the charge is located."

The reason for your confusion is that there are two equivalent ways of looking at what happens with a medium.

A "medium" is a convenient fiction, an approximation. It can be described in terms of such things as dielectric constant and index of refraction, and light "slowing down".

However, all of these quantities are DERIVED from the vacuum equations. You calculate how the charges in the medium respond to electromagnetic fields (by polarizing for instance), and then what fields result from those actions of the charges in the medium. These calculations are all done using vacuum values, as those are the fundamental equations which are always true.

When you do those calculations, you can summarize the effects due to charges in the medium as "medium properties".

Thus, it is true that the force on a charge is always, always, ALWAYS the sum of kQq/r^2 where k is the vacuum value and the sum is over ALL OTHER CHARGES, including those in the medium.

It is also true that you don't have to look at the individual charges in the medium, but can approximate their effects by introducing the idea of a "permittivity of a medium". When you do that, you are doing the process I am saying: summing up VACUUM kQq/r^2 over all the charges of the medium. Note that when people do this, they no longer consider the individual charges in the medium. That's just an approximation, albeit a good one.

But things like "permittivity of a medium" can actually be calculated, by considering those individual charges and using the vacuum equations. I know. I had to do it for exams.

− Randy

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