Re: Q; Various musings

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- *From*: "PD" <TheDraperFamily@xxxxxxxxx>
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On Mar 30, 9:16 am, "G. Ralph Kuntz, MD" <g...@xxxxxxx> wrote:

> I am NOT a physicist, but I am interested in particle physics.
>
> Does the electron have a size or is it a "point" object? If so, it's density should be infinite since it has mass in a zero volume.

Interestingly, density is a concept that applies only to composite objects apparently. There is no evidence that fundamental particles need to have both mass and volume as properties. Extrapolation from our ordinary experience with "stuff" is not sufficient reason to demand it for everything.

When it comes down to it, the volume of composite stuff really has to do with the range of interactions between the constituents. There is nothing interstitial, for example, between electrons and protons, and so there is nothing material that forces the size of atoms other than the nature of the interaction.

> How do forces work at the sub−atomic level? If two electrons approach each other, I understand that the like negative charges repel each other, but what imparts the "thrust" to move them apart? Or an electron and a proton − what causes them to move toward each other? I know that the standard model says that the particles exchange photons, but why does this exchange cause them to move toward or away from each other?

Because the photons carry momentum. When a photon is emitted from one particle, the momentum it carries away produces a recoil in the emitting particle. And when the photon is absorbed, it delivers momentum to the receiving particle. Now, before you get caught up wondering how this can result in attraction as well as repulsion, you should be aware that photons are not little BBs that travel in straight lines between here and there. To understand a little better what photons really do, I suggest you read a short, friendly book by

Feynman called "QED".

> Do the photons "bend" space − as in general relativity?

Well, in some sense yes, but not in the same way that gravity works.

> Is mass quantized?

Not as far as we know.

> When new virtual particles are created, say an
> electron and anti−electron (positron), why do they always mass exactly
> the same amount and not 99% or 102% of the "standard" mass?

Virtual particles don't in fact have the same mass as the "standard"
mass. But the pair creation example you gave is not necessarily a case
of virtual pair production.

> I am reading Brian Greene's book "The Elegant Universe" and it is
> leading to more questions than answers. Good book, though!

That is the *whole point* of a good book like that, to generate
interest and to create more questions than to answer them.

PD

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