Re: The Nature of Mass

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From: David McAnally (*D.McAnally_at_i'm_a_gnu.uq.net.au*)
Date: 06/24/04

Date: 24 Jun 2004 01:54:23 GMT

leoppard@MailAndNews.com (Leonard Pardin) writes:

>D.McAnally@i'm_a_gnu.uq.net.au (David McAnally) wrote in message news:<cbc3abvgl1@bunyip.cc.uq.edu.au>...
>> leoppard@MailAndNews.com (Leonard Pardin) writes:
>>
>> >"N:dlzc D:aol T:com \(dlzc\)" <N: dlzc1 D:cox T:net@nospam.com> wrote in message news:<zH7Cc.76$iU6.14@fed1read03>...
>> >>
>> >> The photoelectric effect cannot be effectively explained by a wave model.
>> >> Light seems to have a dual nature, and in fact so does any particle. Even
>> >> C−60 buckyballs have been made to exhibit the self−interference pattern
>> >> called "diffraction".
>> >>
>> >> David A. Smith
>>
>> > Does not the explanation for the photoelectric effect depend on
>> >frequency? Frequency is a wave phenomenon. I have never fully
>> >understood why a particle model must be employed in the explanation
>> >for the photoelectric effect.
>>
>> Using waves alone, how do you account for the fact that the photoelectric
>> effect works for higher frequency light but not for lower frequency light?
>> There is a certain frequency associated with the substance such that
>> light (no matter how dim) with frequency greater than the certain
>> frequency can cause the photoelectric effect, but light (no matter how
>> bright) with frequency lower than the certain frequency can never cause
>> the photoelectric effect. Using waves alone, how do you explain this
>> phenomenon of a cut−off frequency?

> What about resonance and harmonics? A receptor set at a certain
>frequency will resonate only at that frequency regardless of the
>intensity of the incoming waves. Once the waves are the right
>frequency and reach minimum intensity needed to overcome the inertia
>of the receptor, the receptor will resonate and give off its own
>waves. It seems to me that is a more sensible explanation than
>claiming that matter, in the sense of some solid particle, possesses a
>property resembling "frequency."

Again, this is just arguing by analogy, and reaching mistaken conclusions because you haven't bothered to learn the background to resonance, etc. This is another artifact of your "Look at the Big Picture, and learning the physics will obscure the understanding" philosophy.

Resonance does not behave like the photoelectric effect does. Resonance concentrates on the specific frequency characteristic of the body in question. If the forcing frequency is too low or too high, then there is negligible effect as far as resonance is concerned. On the other hand, the cut−off frequency or characteristic frequency for the photoelectric effect is the greatest lower bound for the frequencies which are capable of making the photoelectric effect work. At all higher frequencies, the photoelectric works just as strongly as at the characteristic frequency, and in fact more so, since the electrons are emitted at higher speeds as the frequency increases. Note the contrast between the behaviour of the photoelectric effect and resonance: at higher frequencies, the photoelectric effect still works as strongly as ever (with electrons becoming faster as the frequency increases), whereas resonance dies down.

Also, if resonance were the explanation for the photoelectric effect, then you would expect that brighter light (at the same frequency) would produce faster electrons. Instead, the emitted electrons have exactly the same speed, but there are more of them (the number being proportional to the intensity).

Finally, the resonant frequency of a body is dependent on various physical properties of the body like its mass and its physical extent (amongst others), whereas the characteristic (photoelectric) frequency of a body is dependent only on the type of material, and has no dependence on the mass, physical extent, etc. In other words, the characteristic (photoelectric) frequency is an intrinsic property of the material out of which the body is made. The contrast with resonance (with its explicit dependence on mass, physical extent, etc) is evident.

Any one of these three reasons would be enough to reject resonance as an explanation. So you see that having quantitative information about the behaviour does lead to specific conclusions that your "Big Picture" philosophy fails to provide.

David

> And all dared to brave unknown terrors, to do mighty deeds,
> to boldly split infinitives that no man had split before −
> and thus was the Empire forged.

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