Re: High school experiment examining particle−wave duality?

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- *From*: "Sue..." <suzysewnshow@xxxxxxxxxxxx>
- *Date*: 23 Oct 2006 11:07:57 −0700

Coyn wrote:

> For a (relatively large) high school project, I would like to examine particle−wave duality. I was wondering what experiments I could do to this effect.
>
> Ideally, I would love to look at the wave nature of the electron. An electron ray shouldn't be too hard to come by (can I effectively get one out of an old CRT monitor?), but is it feasable to send the electron ray through a grating and see interference patterns? I suppose that vacuum is needed for this, as well as something (photographic?) which can detect the trace of the electrons on the other side of the grating. According to de Broigle, the wavelength L of an electron is something like mc^2=hc/L => L = hc/(mc^2) = h/mc= 2.42 pm. Is it even possible to get a grating fine enough to produce any diffraction? Any tricks that can be used? Or any other experiments you can suggest?
>
> Thanks in advance
> Coyn

<< We believe that we carried out the first experiment in which the build−up process of an interference pattern from single−electron events

could be seen in real time as in Feynman's famous double−slit Gedanken experiment under the condition, we emphasize, that there was no chance of finding two or more electrons in the apparatus. >>

−−Akira Tonomura
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http://physicsweb.org/articles/world/15/9/1

<< in 1961 Claus Jönsson of Tübingen, who had been one of Möllenstedt's students, finally performed an actual double−slit

experiment with electrons for the first time (Zeitschrift für Physik 161 454). >>
http://physicsweb.org/articles/world/15/9/1

http://www.hqrd.hitachi.co.jp/em/doubleslit.html

<<Now, does not the prize to Einstein imply that the Academy recognised the particle nature of light? The Nobel Committee says that Einstein had found that the energy exchange between matter and ether occurs by atoms emitting or absorbing a quantum of energy,hv .

As a consequence of the new concept of light quanta (in modern terminology photons) Einstein proposed the law that an electron emitted from a substance by monochromatic light with the frequency has to have a maximum energy of E=hv−p, where p is the energy needed to remove the electron from the substance. Robert Andrews Millikan carried out a series of measurements over a period of 10 years, finally confirming the validity of this law in 1916 with great accuracy. Millikan had, however, found the idea of light quanta to be unfamiliar and strange.

The Nobel Committee avoids committing itself to the particle concept. Light−quanta or with modern terminology, photons, were explicitly mentioned in the reports on which the prize decision rested only in connection with emission and absorption processes. The Committee says that the most important application of Einstein's photoelectric law and also its most convincing confirmation has come from the use Bohr made of it in his theory of atoms, which explains a vast amount of spectroscopic data. >>
http://nobelprize.org/physics/articles/ekspong/index.html

Sue...

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