Re: Wave / Particle contradiction

Source: http://sci.tech−archive.net/Archive/sci.physics/2007−04/msg02169.html

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- *Date*: 17 Apr 2007 23:57:27 −0700

On Apr 17, 8:48 pm, part...@xxxxxxxxx wrote:

> "Everyone knows" there's a contradiction between the wave and particle
> concepts − a wave can't be a particle and vice versa. I never
> understood it. Can someone please explain?
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> I understand wave to be any physical phenomena that satisfies the wave
> equation. For a particle I didn't find any definition, but intuitively
> it means something with energy, momentum and maybe velocity, defined
> in some region of space/time. Why can't such a thing also satisfy the
> wave equation? The only problem is that it may be somewhat hard to
> imagine.

In classical mechanics a point particle might be defined as an object that occupies only a single point in space at a given time. A solution to the wave equation assigns some value to every point in space at once. A single classical mechanical particle would have to be at many different places at once in order for some property of the particle to satisfy the wave equation. A classical probability distribution would be better, but then you run into the problem that probability is always positive. You could do it with multiple classical particles −− think sound waves −− but experiments have demonstrated the interference is still there when only one particle is in the apparatus at a time.

Ultimately, the problem is resolved by quantum mechanics. For a single particle, the laws of quantum mechanics are essentially that the particle obey a certain wave equation. And further down the road, a bunch of particles obeying quantum mechanical laws is equivalent to a solution of the wave equation obeying what you might call a quantum mechanical version of the appropriate wave equation. And yes, you could say quantum mechanics is hard to imagine; I'd say it's hard to understand what's going on in between observations of a system.

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Jim E. Black

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