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Wave packets

This note is about the relation of wave packets to Planck's constant "h"

I know what a wave packet is. I know something of the mathematics of wave packets although I could not reproduce it without checking a book. I have a sense of how Fourier helps with wave packets. A wave packet stabilizes a wave, especially a wave that is periodic but not infinite. A wave packet is made up of one, or more, cycles of a big wave with a lot of little waves "underneath" the big wave. The small waves stabilize the big wave by alleviating uncertainty inherent in the big wave. The small waves have uncertainty as well, but the combination of the big waves and the small waves yields greater certainty than the big wave alone. The uncertainty in the big wave, and in the small waves, comes both from their nature as waves and from the Uncertainty Principle. I don't know how to separate the two uncertainties, or if they really are fundamentally different or separable. The uncertainty applies to both the momentum (energy) and position of the wave.

Here are the basic questions:

Imagine a single quantum of energy, h, and a fundamental particle, say a lepton or quark, composed of several h.

Think of h as like a fundamental particle or a single wave. Is each h a wave packet? If so, how? If not, why not? If so, are there waves smaller than the wave associated with 1 h that make up the big h?

Is each fundamental particle a wave packet? As a wave packet, is the particle 1 big wave with a lot of little waves supporting it? If so, are the h in the fundamental particle the small waves that support the big wave that is the particle?

Is each fundamental particle several waves? Is each wave a wave packet? How are the wave packets composed? What is their relation to the identity of the whole particle?

If the particle is composed of a cluster of packets, is each packet based on the particle's component h? Or is each packet based on the small waves that make up the component h?

Here is some clarification, contributing issues, and contributing questions:

h not as a simple thing but as a wave packet.

I think, in theory, it is possible to have something smaller than h as long as the "something smaller" does not by itself lead to a transfer of energy, that is, lead to action. The "smaller than h" can never appear apart from their bound identity in h. All of the "smaller than h" in a particular h must be transferred in their entirety whenever h is transferred. I am not sure how we could ever find them apart from h - the same

problem with “strings” or “branes”. So I am not sure what sense it makes to speculate about them, but they might be a preferable alternative to the alternatives below. If we accept that “smaller than h” might be possible, it makes sense to ask if they are always exactly the same in every case of an h. The fact that every h is exactly like every other case makes it seem the component “smaller than h” would be the same in every h, the number of “smaller than h” would be the same, and relations among the “smaller than h” would be the same. We can ask that of any wave packets that make up any fundamental particle.

I don’t like the idea of anything smaller than h. I prefer to think of h as the smallest thing. But, if so, we have to think what h is. If h exists, then h is a wave or particle. As a wave or particle, it has to cohere. If it coheres, we have to ask if it is a wave packet. If it is a wave packet, we can ask about something smaller. In theory, this could go on down to infinity. I don’t want that. I want a limit (atomos). So I want h to be the lower limit. What kind of limit?

Essentially in what follows, I ask the same questions of particles bigger than h.

An electron, or any fundamental particle, has to be made up of exactly some integer number of h. I don’t know what that number is, and it doesn’t matter for here.

One fundamental particle as a wave packet made up of many h as the smaller waves.

Maybe the whole larger particle is one wave packet. What is it made up of? The natural candidate is the h as the small waves that make up the bigger standing wave that is the particle. This idea is fine, for a while. I guess that most particles are made up of more than half-a-dozen quanta, many more. If so, the mechanics (mathematics) of how all the h enter into the whole particle as small waves in one large wave packet can get a bit confusing. It seems unlikely that each h is one small wave contributing equally to the whole particle as one wave packet.

Suppose that all the h do contribute as small waves to the big particle that is the wave packet. Not all basic particles are the same size, so not all basic particles can have the same number of h compose them. In addition, the size of the particle, and thus the number of h in the particle, can change according to energy added to the particle. What governs how many h are allowed to go together to make up one wave-packet-particle? What governs how many particle sizes there can be, either when resting or when energized?

(Think about relativistic effects later).

h clustered in packets, the fundamental particle made up of clusters of clusters of h.

Suppose there is nothing functionally smaller than h. Suppose h can come in clusters so each cluster makes up a wave packet. These intermediate wave packets might have half-a-dozen h in each intermediate cluster. Groups of these intermediate wave packets make up the big particle as a larger wave packet.

The same questions apply. What governs how many h make up one intermediate wave packet? Does the relation change depending on the greater context, that is, on how the intermediate wave packets are held into particular fundamental particles such as electrons or quarks? What governs how many intermediate wave packets go into one particular kind of particle, either resting or when energized?

How are we to think about a particle as a wave packet?

How are we to think about the relation between the waves in the wave packet and h?

None of the obvious relations is without serious problems. I can’t think of any obvious relations other than the ones I have sketched above.

I will look more into wave packets and this topic.