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Amplitude of a light wave

A

A real wave has amplitude. Any wave that I want to call a real wave has amplitude; and it has specific amplitude. Apparently light does not. This aspect is not clear in pop physics books. When pop books draw pictures of light waves, they draw the usual transverse wave, with two waves, at right angles to each other (orthogonal), in perfect phase. The wave apparently has amplitude. I accept that the amplitude is an artifact of having to draw the wave for educational purposes. I accept that light has no real amplitude. But that means, to me, light isn't a regular wave. It is something else, something that happens to have wave-like properties when we pay attention to it as it moves around.

With normal waves, the greater the amplitude, the greater is the energy. With normal waves, frequency is not necessarily directly related to amplitude (energy). I don't go into which non-light naturally occurring waves might show an association of amplitude with energy and which do not. With light, the greater the energy, the higher is the frequency and the shorter is the wavelength. It might be tempting to associate higher energy and higher frequency with greater amplitude but apparently we can't do that.

All this would not be much of problem except that Maxwell's equations incorporate magnetic flux and electric flux, and, to the extent that I understand those, they occur through time and SPACE. Maxwell's equations seem to imply amplitude. I think early researchers on EM took them that way, although I do not know about theories of amplitude among early researchers. If we deny that light has amplitude, I don't know what the implications for Maxwell's equations are. I am sure the equations stand, I just don't know how. What is the role of flux in equations without amplitude?

B

I think the following point comes out of my ignorance and shows my ignorance. Because electric and magnetic flux are exactly in phase all the time in a light wave, it seems that sometimes both would be at maximum flux and minimum flux. In pictures in pop books, these points would be at points of highest amplitude and lowest amplitude. It seems lowest amplitude coincides with zero flux both for magnetic flux and electric flux. If both go to zero flux, why does the wave continue to propagate? Why doesn't it just end? I admit I have not studied Maxwell's equations much, and do not understand them well, so that is likely the root of my misunderstanding here.

There is a book called "Maxwell's equations for students", I think by David Fleisch, and apparently it is well done. The author of that book wrote other helpful books, of which, one is, I think "Div, Grad, Curl and All That". I intend to read those books and other similar helpful books. Still, if any reader of this note has any suggestions, I would appreciate them.

In quantum mechanics (quantum field theory), I think especially in gauge theory, the specific phase of the wave function at any point is not supposed to matter. Phase and amplitude seem to be closely related. So this apparent problem about phase might not make sense in that perspective. I am not sure what the irrelevance of phase implies for amplitude in QM. I am not sure that the irrelevance of phase implies if the amplitude might reach zero when electric and magnetic flux are in perfect phase, or might reach some maximum. In most QM, it seems (to me) that the wave equations of particles cannot be perfectly zero at some point in their normal habitat (say an electron in “orbit”), and I am not sure what that implies for the wave equation of light, the irrelevance of phase, and the apparent problems that I am puzzled by.