The waves and particles

We know the wave particle nature of light. We also know that particles such as an electron or a proton manifest themselves as a wave. What's the difference? However, photon as a wave is also characterized by particle behavior. The photon is able to knock out an electron from the atomic orbit if it has a certain mass. In other words, it is purely particle-like. But it also has a wavelike nature - dispersion of light, interference, etc. Classic particles as an electron. It has both wave and particle character. How it differs e.g. electron from photon? But they both have mass, they both act like particles, and they both act like waves. The first and definite difference is that the mass of a photon (energy or frequency) is fully connected to its movement. In addition, the speed of movement is constant, equal to the speed of light. When a photon loses energy, e.g. by passing some of its momentum to an electron, its frequency decreases, but the velocity is still constant. The photon particle (wave pack) acts as a regular particle (transmission of momentum, same angle of impact and reflection). But it doesn't exactly behave like a classical particle. For the photon particle does not lose its velocity (it is still constant), but loses its energy, so its frequency (and therefore its mass) decreases. Whereas the particle loses its velocity when passing momentum to another particle or even a photon. This is the fundamental difference between an electron and a photon! The photon is moving at the same speed, and the only thing that's changing is its frequency. Whereas a particle can move at different speeds between 0 and the speed of light c. So is his frequency. But there's a difference with a photon. When a photon is released almost from its energy (mass), its frequency approaches 0 (speed is still constant). See the Fig. 1.

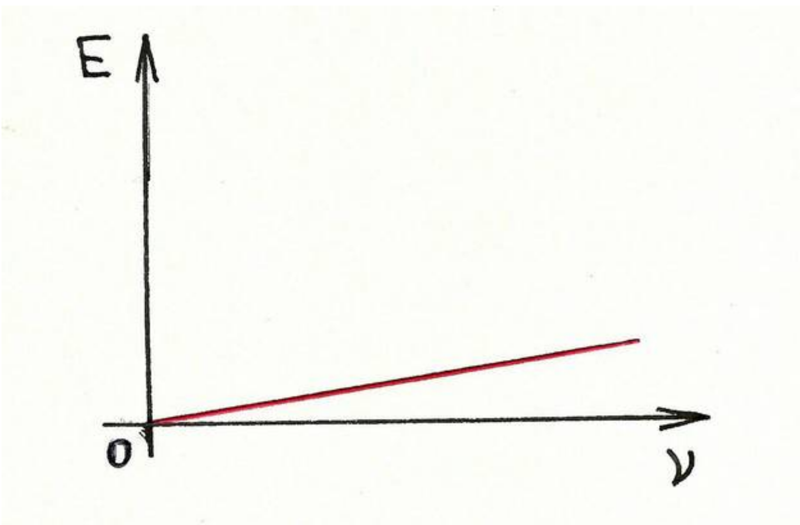

Fig. 1 – the function of E (energy) to a a frequency (v) of one photon

In other words, a photon as a particle can dissapeared and its energy is passed to the electron to increase its velocity. The situation is different for an electron. When the velocity of an electron approaches 0, its energy (mass) also decreases, but it does not decrease in direct proportion to 0 as in a photon. Even if we're approaching 0 with the velocity of an electron, there's still going to be a certain amount of energy. It seems as if there is some basic energy (mass) that doesn't just disappear. This energy or mass (whatever you call it) is called resting energy or resting mass. You have to realize that the electron can't be in absolute rest, it will always move somehow, even if it vibrates as a result of "bound" internal energy (see the spinning flywheel). It is understandable that if we accelerate such a flywheel (think of it as a bound frequency - see the standing waves in the flute), its energy (mass) will increase. For the frequency of internal standing waves will increase (just to give you an idea). Curiously, an electron can't slow down to zero velocity, but it can't accelerate to the speed of light. I think we know why. For then the frequency of the inner bound wave would approach infinity. And that would bring it closer to the infinity of its energy (mass).

Summary: The photon always has a constant speed. Of course, in a vacuum Of course, even a vacuum has an inner life, and it is more or less clear that the speed of photons changes slightly due to vacuum fluctuations, but on average it evens out. Further, the photon can hardly be stopped if its velocity is approaching 0, its frequency is also approaching 0 (the wavelength is increasing to infinity). The photon can't even be accelerated to a higher speed, because if we "accelerate" the photon (transmit energy) it will only increase its energy. His frequency will increase. Here, too, there is a limit - the frequency of a photon cannot rise to infinity. Its energy would then be greater than the energy (mass) of the existing universe.

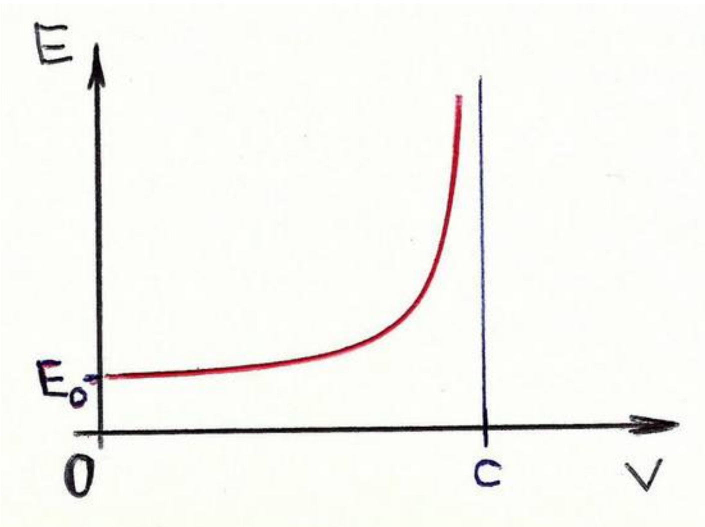

Fig. 2 – the function of E (energy) to a velocity (v) of one electron

Same goes for the particle, but in a different way. As the velocity of the particle approaches 0, the energy (mass) of the particle remains high. See the Fig.2.

In another, we must mention L. de Broglie's theory. That is, the so-called pilot waves that conduct the above particles in a given space. And whose velocity can take almost infinite values for a near-standing particle like an electron. At the same time, the speed of the pilot waves is the same as that of particles like photons.

to be continued