About one missing model in physics (StW).

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Abstract.

A simplified model of representation of particles with nonzero rest mass by quasi-classical standing wave is discussed. This model is offered as a pair for the model of photon represented by a traveling fragment of quasi-classical wave. We discuss the usefulness of these simple models to analyze a certain range of physical problems.

We know that physics is based on models. Each model aims to explain a range of phenomena and all models have a limited area of applicability. Such phenomenon as light, for example, has many different models. But even the oldest of them (solid particles) currently has its scope, whereby it explains in the simplest way certain physical aspects of light propagation. Among these models there is one that is situated at the boundary between the classical and the new (relativity, quantics) physics. This model (we denote it RunW) represents a particle of light (i.e. a photon) by a fragment of traveling quasi-classical wave that preserves its wholeness and has a strictly defined frequency depending on its energy. This is a very important model, exactly because of its position at the boundary between evolving concepts in physics and its simplicity. Note that this model uses the concept of ether as the wave medium.

In connection with this model we notice that in this boundary region of physical concepts we lack for similar simple models for the particles with nonzero rest mass, though there are preconditions for constructing such a model. We denote it by StW and it could be based on a stable wave object of standing wave type, which is further able to move. The mechanical wave concept is close to the classical approach in physics. We assume that there is some modified form of photon, i.e. traveling wave, closed to itself. A significant precondition for such a model is the presence of frequency in the objects with nonzero rest mass associated with their internal energy, analogous to the photon. This model is usually subjected to two objections. The first objection is the rejection of the ether as a wave medium. The second one is the difficulty to explain the stability of such objects. Note that the modeling of a photon by traveling wave is accepted more easily, although the above-mentioned objections to StW are valid for the RunW model as well.

Let us consider the first objection related to the ether. The rejection of the ether as a wave medium arose with the advent of relativity theory, according to which all inertial systems are symmetrically linked through Lorentz transformations. In all inertial reference systems, the speed of light is the same c and constant in all directions. The complete formal symmetry of systems, as is often the case with formal approaches, is transformed into a requirement for all inertial systems to be symmetrical to the supposed wave medium, which in principle is impossible. But if you make the assumption that all objects with nonzero rest mass are the wave objects on medium with the wave parameter c or close to it, this situation changes radically.

Obviously, if the wave object of standing wave type begins to move, it undergoes distortions. To preserve the node structure of the object in motion, the wavelength of the forward component must become less than that of the backward one. And because of the different longitudinal wavelengths, the oscillations at antinodes cease to be synchronous. Imagine a group of wave objects moving together relative to the medium. Moving together relative to the wave medium, all objects of this group experience the same distortions. Generally speaking, such can be our world, seen in a certain inertial system in which these objects are moving relatively slowly in respect to the speed of light *c*. How will a physicist build up his theory in such systems? He will try to represent all phenomena using the simplest physical models. In the inertial system with Lorentz transformations, the form of classical wave operator remains the same, exactly as in systems resting on the wave medium. This also means that all wave objects appear in these systems as they would be observed in systems resting on the wave medium (including the speed of wave propagation *c*), i.e. the simplest model for wave objects. Therefore, developing physics will be doomed to come to use Lorentz systems, in which all wave objects are perceived undistorted (as if they were seen at rest from a system resting relative to the medium).

Thus, with the overall symmetry of all inertial systems with Lorentz transformation, only a part of them must be connected with the wave medium. But in all of them all wave phenomena, including wave propagation velocity *c*, will look like those in systems resting on the wave medium. And marking out this part of the actual resting systems from their total number is extremely difficult (perhaps with some very subtle effects).

Let us now consider a hypothetical scenario in the historical development of physics in such a system of only wave objects (StW and RunW), if physicists don't know about it because of weak manifestation of wave properties (with parameter *c*). In the Cartesian system that moves relative to the wave medium there is a particular direction, which is oriented along the velocity vector of the moving system. At some stage of its development, physics will require the so-called inertial systems to be isotropic, that is there should be no preferred directions to be identified in any inertial system (and in the formulas as well). And only by this requirement, without realizing it, the scientists of the wave world definitely bring their physics to Lorentzian systems, because only in these systems the properties of waves are isotropic. This linkage will not particularly manifest itself in classical mechanics. However, rising suddenly from the isotropic equations of electrodynamics, the logical conclusion to follow will be that the electromagnetic waves propagate in all inertial systems with the same speed independently of their actual direction.

Then, subsequent experiments will be conducted to identify the possible preferred directions for light. It would be useless, and not because there is no ether, but because of the same common distortions of all objects. There is no preferred direction in systems with compensated distortions, as in systems resting on the wave medium. Then a logical question that would arise with this experiment is how solid particles freely pass through solid and "very hard" ether? How do physical bodies carry ether along? Then it will be discovered that all of these results perfectly fit into a formal scheme that admits a distortion of the space-time, which can be predicted mathematically by postulating the invariance of the light speed *c*. Therefore, there is no need at all for such a concept as the ether. Nevertheless, we should take note on the well known fact that even Einstein in his later years inclined to admit the idea of ether as the wave medium in the usual sense.

The scope of requirements on the real world objects can be extended beyond the quasi-classical wave objects. We further require that the mathematical form of the physics laws described by operators do not change their form as the result of Lorentz transformations. This may address, for example, Klein-Gordon equation. However, this equation cannot be applied to a medium since a general property of a medium cannot depend on the individual integral parameter m of a concrete particle.

Consider the second objection related to the instability of structures being modeled as quasi-classical wave objects. In principle, the stability of RunW objects could be explained by a slight decrease of the wave velocity c in the zones of increased density of wave energy. That is, we assume that the traveling wave is building a kind of corridor with vague side walls. Recall that one of the explanations for the bending of photon trajectories by gravitational mass consists in admitting a decrease of c due to accumulations of mass. Within these corridors occurs focusing of a running wave. To further sustain this hypothesis we also mention the effect of total optical internal reflection, that is, a strong reflection of tangential waves in the direction of decreasing c. This could also be formulated as the turn of the wave front at variable velocity.

Suppose now that we bend this corridor to make it closed. The result is a closed contour, with a wave propagating along it in one or in both directions. In general, we obtain the structure similar to a standing wave, especially at some distance from the contours. The contour shape can be very different.

Another variant. If the medium has some nonlinearity, it may be that the wave structure with large amplitudes has some advantage. In this case, at the same energy couple oppositely-directed waves has an advantage over unidirectional wave. That is at significant amplitudes the direct wave can generate and feed backward wave. Such structures must be considered in pairs.

For some of our purposes, StW objects can also be regarded as a set of plane waves propagating in all directions.

The flows of wave energy at the location of the StW object can be identified up to a factor with conventional momenta. With the StW object at rest the energy flows are balanced and the total momentum is null. As the StW object begins moving, each wave vector of its plane components should see a vector shift in appropriate direction. The flow of energies in the StW cease to be compensated. However, in a particular Lorentz system, which is the rest system of the material object, this StW-object looks quite the way as it would at rest.

Even if our proposed StW model does not necessary have a matching correspondence in the reality (which is possible in principle), it remains very useful in many respects. For example and as demonstrated above it allows us to take a look from the outside at the history of physics. Using the concept of a special conditional StW object, which in a state of rest consists of identical all-directional plane wave components, is very convenient at least for purely cognitive purposes. By using this StW model we can well preact the study of SRT by means of formal constructions based on its postulates. Many of the features of SRT are clearer identified in these StW structures, such as: the retardation of oscillations, the phase shifts along line of moving, the need for coordinate transformations and the introduction of “proper” time for each reference system in order to make the StW appear like at rest, the preservation of the transverse lengths, the change in energy by means of the corresponding relativistic multiplier, meaning of rest mass and its relationship with energy, etc.

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