# LOCALIZATION AND VARIABLE MASS OF PHOTONS IN THE EXTENDED SPACE MODEL

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**Abstract.** We consider the 5-dimensional extended space model (ESM). The interval is used as the fifth coordinate [1-4]. As a fifth additional coordinate the interval s is used. The physical meaning of the fifth coordinate is an Action S [5]. This value is constant under the usual Lorentz transformations in 4D Minkowski space M(T;X,Y,Z), but it changes when the new types of transformations (T;S) and (X,S) in the 5D Extended space G(T;X,Y,Z,S) are used. In the frame of this model, we investigate the problem of uprising of nonzero photon's mass and localization of photon under the influence of external effects. The value and nature of this effect can be connected with linear transformations in the Extended space. The explicit form of the values of photon's mass and the size of its localization is found. The formulas expressing these values are connected with O(1,4) group transformations. The Lorentz group O(1, 3) is a subgroup of this group In the ESM cut off parameters both in coordinate and momentum spaces are arise automatically and, therefore, are the objects that are invariant under of O(1,4) group transformations. In the ESM all objects both fields and particles initially possess corpuscular and wave properties, this fact allows one to explain naturally wave-particle duality. In the ESM 5-vectors of energy-momentum-mass are compared to particles and fields. They are a generalization of the usual 4-vectors of energy-momentum. These vectors are belong to the 5-dimensional Extended space G(1, 4). Vectors, which are correspond to free particles, both massive and massless, are isotropic, i.e. their length in the space G(1; 4) is equal to zero. The transformations of such vectors can be described by rotations in the Extended space. Using such transformations, it is possible to describe an external action at the particle, as well as the particle entering into a certain environment or field. The fifth coordinate of the energy-momentum-mass vector corresponds to the mass of the particle. The group O(1; 4) transformations can change this mass. In particular a photon can get non-zero mass, and this mass can be both positive and negative. In the frames of the ESM one can establish a connection between the mass of a particle and its size. The starting point for us is the analogy between the dispersion relation of a free particle and the dispersion relation of wave mode in a hollow metal waveguide. With the help this analogy one can associate with a particle a linear parameter, which is determined by its mass. Thus, the scheme by which size is an associate with a particle as follows. In an empty Minkowski space a free particle is described by a plane wave. When it gets into environment, or in an external field, its mass changes, that is described by a hyperbolic rotation in the Extended space. Some linear parameter can be associated with this new mass. We interpret this linear parameter as a particle size [4-5].

## References

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