Coordinateless construction of space-time geometries

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Abstract

A new general method of the space-time geometry is suggested. Any geometry $\mathcal{G}$ is constructed as a result of deformation of the proper Euclidean geometry $\mathcal{G}_{\mathrm{E}}$. One proves that the proper Euclidean geometry $\mathcal{G}_{\mathrm{E}}$ may described completely in terms of the world function $\sigma_{\mathrm{E}}(P,P') = \rho_{\mathrm{E}}^2(P,P')/2$, where $\rho_{\mathrm{E}}(P,P')$ is the Euclidean distance between the points P and P'. It means, that any geometrical object $\mathcal{O}_{\mathrm{E}}$ and any relation $\mathcal{R}_{\mathrm{E}}$ of $\mathcal{G}_{\mathrm{E}}$ can be expressed in terms of the world function σ_{E} in the form $\mathcal{O}_{\mathrm{E}}(\sigma_{\mathrm{E}})$ and $\mathcal{R}_{\mathrm{E}}(\sigma_{\mathrm{E}})$. Any geometrical object $\mathcal{O}$ and any relation $\mathcal{R}$ of the geometry $\mathcal{G}$ can be obtained in the form $\mathcal{O} = \mathcal{O}_{\mathrm{E}}(\sigma)$ and $\mathcal{R} = \mathcal{R}_{\mathrm{E}}(\sigma)$, where σ is the world function of the geometry $\mathcal{G}$. In other words, any generalization $\mathcal{G}$ of the Euclidean geometry $\mathcal{G}_{\mathrm{E}}$ is obtained as a result of deformation of the proper Euclidean geometry, which is described by the change $\sigma_{\mathrm{E}} \to \sigma$. Geometry $\mathcal{G}$, obtained by this way is called the tubular geometry (T-geometry). The T-geometry is a more general geometry, than the RIemannian one. Using T-geometry as the space-time geometry one can construct the deterministic space-time geometries with primordially stochastic motion of free particles and geometrized particle mass. Such a space-time geometry defined properly (with quantum constant as an attribute of geometry) allows one to explain quantum effects as a result of the statistical description of the stochastic particle motion (without a use of quantum principles). Geometrization of the particle mass appears to be connected with the restricted divisibility of the straight line segments. The statement, that the problem of the elementary particle mass spectrum is rather a problem of geometry, than that of dynamics, is a corollary of the particle mass geometrization.