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Motion of a particle in the Bogoslovsky-Finsler space-time and the fate of the broken Lorentz invariance

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We study the motion of a particle in the Bogoslovsky-Finsler space-time, where a Lorentz violation takes place due to a non-zero continuous parameter in the action. We demonstrate that the broken Lorentz symmetries are substituted by a different type of symmetry. The new symmetry vectors are generators of higher order (or hidden) symmetries that are related to integrals of motion which are rational functions in the momenta. On mass shell the generators can be seen as space-time vectors producing diffeomorphisms.

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