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Geometrizing Fermionic QFTs via Supermanifolds

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We always have the freedom to reparametrize any QFT without affecting the underlying physics, but this freedom is not always manifest in the way we write it down. Vilkovisky demonstrated that the standard definition of the effective action yields different off-shell results for different parametrizations of the same theory. This issue is neatly resolved through the covariant Vilkovisky-De Witt (VDW) formalism, which offers a geometric interpretation of a QFT as a (pseudo)Riemannian manifold, in which the fields take on the role of coordinates. Reparametrizations are therefore realized through diffeomorphisms in this field-space manifold, which leave the physics manifestly invariant. However, the application of this covariant formalism to fermionic degrees of freedom and the proper definition of the fermionic field space metric have been elusive. In this talk, I will demonstrate how the VDW formalism can be extended to take into account both scalar and fermion fields. This is made possible by promoting the field space manifold to a supermanifold, which is equipped with a supermetric. In this way, the space of QFTs becomes fully geometrized, and every theory can be written in a manifestly reparametrization-invariant manner.

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