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Conformal scalar and spinor fields in curved space

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These fields scale as, $\tilde{\phi}(\psi) = \Omega^{\xi} \phi(\psi)$ and the metric tensor as $\tilde{g}_{\mu\nu} = \Omega^2 g_{\mu\nu}$, where Ω and ξ are called the conformal factor and wight, respectively. The conformal mass in Klein-Gordon mass (\tilde{m}) is related to original scalar mass, (m) by $\tilde{m} = \Omega^{-1} m$, Moreover, the Klein-Gordon equation in the conformal's frame reduces to the quantum Telegraph equation of a particle whose mass is given by, $M = (\xi + 1) m$, in Minkowski's frame. The conformal wave equation in 2 dimensions with $\xi = 1$ yields the quantum Telegraph equation with a mass. We have found that the conformal wave equation in 2 dimensions yields the Dirac equation for $\xi = \pm i$ in flat space. In 4 dimensions the mass of the conformal spinor field scales as $\tilde{m} = \Omega^{-2}m$. The spinor charge (q) is influenced by the conformal transformation and becomes $Q_c = q\xi/(\xi + \frac{3}{2})$. The conformal factor for a spinor field is found to be equal to the phase factor of the spinor field. Moreover, the conformal transformation that transforms the Klein-Gordon equation into the Dirac equation. An Aharonov- Bohm-like effect is found to occur due to a conformal transformation of the spinor field. Breaking of conformal invariance is found to give rise to a mass of the particle that is tantamount to the Higgs mechanism.

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