Contribution ID : **43** Type : **not specified**

Conformal scalar and spinor fields in curved space

четверг, 30 ноября 2023 г. 15:15 (35)

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 preserves the probability of the spinor particle. There exists a certain 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.

Presenter(s) : Prof. ARBAB, Mohamed (Qassim University and Khartoum University)

Session Classification : Afternoon session 30/11/2023

Track Classification : Gravitation & Cosmology