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The hyperbolic equations in the curved spacetime

Abstract

The talk is concerned with the global in time solutions of the Cauchy problem for matter waves propagating in the curved spacetimes, which can be, in particular, modeled by cosmological models. We examine the global in time solutions of some class of semililear hyperbolic equations, such as the Klein-Gordon equation, which includes the Higgs boson equation in the de Sitter spacetime and Einstein & de Sitter spacetime. In particular we show that the Klein-Gordon equation in the de Sitter spacetime obeys the Huygens' principle only if the physical mass m of the scalar field and the dimension n of the spatial variable are tied by the equation $m^2 = (n^2-1)/4$. Moreover, we define the incomplete Huygens' principle, which is the Huygens' principle restricted to the vanishing second initial datum, and then reveal that the massless scalar field in the de Sitter spacetime obeys the incomplete Huygens' principle and does not obey the Huygens' principle, for the dimensions $n = 1, 3$, only. Thus, in the de Sitter spacetime the existence of two different scalar fields (in fact, with $m = 0$ and $m^2 = (n^2-1)/4$), which obey incomplete Huygens' principle, is equivalent to the condition $n = 3$. For $n = 3$ these two values of the mass are the endpoints of the so-called in quantum field theory the Higuchi bound.

Bibliography

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