# Unruh effect

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## Contents



Defining

$$x_- = t - x, \qquad x_+ = t + x. \tag{0.1}$$

# 1 Two-dimensional classical field

$$\mathcal{L} = -\sqrt{-g}(g_{\mu\nu}\partial_\mu\partial_\nu\Phi). \tag{1.1}$$

In flat space-time with Minkowski metric,

$$(\partial_t^2 - \partial_x^2)\Phi = 0. \tag{1.2}$$

Solve eq. (1.2) simultaneously with

$$\mathrm{i}\mathcal{B}_x\Phi = \frac{\kappa}{a}\Psi \tag{1.3}$$

to find a complete set of basis of solution, where

$$\mathcal{B}_x = x\partial_t + t\partial_x \tag{1.4}$$

is the Lorentz boost generator in the $x$ direction, and is time-like in $L$ and $R$ region.

One finds the basis of solutions in $R$ region to be

$$\left[N\left(\frac{-x_-}{x_{-0}}\right)^{+\mathrm{i}\kappa/a}, N\left(\frac{x_+}{x_{+0}}\right)^{-\mathrm{i}\kappa/a}\right]. \tag{1.5}$$

Requiring phase at $(t,x) = (0, 1/a)$ to be zero yields $x_{-0} = x_{+0}$.