Covariant relativistic space-time string

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Abstract

Relativistic, space-time, string is described in the framework of the covariant theory first introduced by Stueckelberg (1941) [1], and further developed by Horwitz and Piron (1973) [2]. The "center of mass" and the "angular" motion are assumed to be classical, while the internal motions (oscillations) are quantized.

The string model is a chain of space-time events (particles), where each of the particles interacts with its nearest neighbors via generalized elastic, interval dependent force of the form $\kappa\rho^2$ in which κ is a constant and ρ is the space-time interval. We show that the particles of the string form a plane. That plane has to be space-like if we demand that the system converges to a Newtonian case in a nonrelativistic limit.

The Fourier transform of the relative motion gives a set of independent relativistic harmonic oscillators in the harmonic modes space. Quantized solutions for relativistic harmonic oscillator, derived by Horwitz and Arshansky (1989) [3], are used here to describe the spectrum of the relative motion.

Mass and energy spectrum of the string are derived and compared to the Nambu-Goto string results [4].

Bibliography

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