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On Various Aspects of DBI Lagrangian Dynamics and its Mechanical and Cosmological Realization

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The DBI Langrangian (or a family of DBI Lagrangians) has been known and widely considered in many different fields of physics.

For instance, classical and quantum dynamics of tachyon systems have been examined, describing spatially homogeneous scalar fields, in the limit of classical and quantum mechanics.

Understanding and modelling of these systems are of particular importance in the development of field and string theory. We review its application in modern cosmology and in the theory of inflation. The focus is on the study of the dynamics of a scalar tachyonic field with a non-standard Lagrangian of a DBI type, or a Lagrangian used in the so-called effective field theories, with various potentials.

It is suitable to use lower-dimensional models, including a zero-dimensional classical-mechanical analogue.

The original calculations for several specific and important (tachyon) potentials are presented.

Those potentials are also exactly solvable in the framework of Friedmann cosmology, and they have physical motivation in inflationary cosmology.

In addition, the so-called locally-equivalent Lagrangians of the standard type are considered. The classical and quantum formalism for a harmonic oscillator with time-dependent frequency is given as an example.

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