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A study of tachyon dynamics for broad classes of potentials

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Abstract

We investigate in detail the asymptotic properties of tachyon cosmology for a broad class of self-interaction potentials. The present approach relies on an appropriate re-definition of the tachyon field, which, in conjunction with a method formerly applied in the bibliography in a different context allows us to generalize the dynamical systems study of tachyon cosmology to a wider class of self-interaction potentials beyond the (inverse) square-law one. It is revealed that independent of the functional form of the potential, the matter-dominated solution and the ultra-relativistic (also matter-dominated) solution are always associated with equilibrium points in the phase space of the tachyon models. The latter is always the past attractor, while the former is a saddle critical point. For inverse power-law potentials $V \propto \phi^{-2\lambda}$ the late-time attractor is always the de Sitter solution, while for sinh-like potentials $V \propto \sinh^{-\alpha}(\lambda\phi)$, depending on the region of parameter space, the late-time attractor can be either the inflationary tachyon-dominated solution or the matter-scaling (also inflationary) phase. In general, for most part of known quintessential potentials, the late-time dynamics will be associated either with de Sitter inflation, or with matter-scaling, or with scalar field-dominated solutions.

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