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Field equations for spinning cosmic strings in Brans-Dicke theory of gravitation

The Brans-Dicke theory of gravitation is a scalar-tensor theory, which foresees the gravitational interaction being mediated not only by the graviton, but also by a scalar field. The theory is recently being studied, because it seems to be more appropriate for understanding the early formation of the Universe and has contributed to the development of unified theories of fundamental interactions. The Brans-Dicke gravitation indicates the possibility of the existence of objects called cosmic strings, approximately one-dimensional and very dense lines, which connect different regions created nanoseconds after the Big Bang, reaching the length of the known Universe. They are considered topological defects, which arose from a spontaneous symmetry breaking. There is a kind of cosmic string poorly understood, called spinning cosmic string, whose dynamics is associated with Gödel's solution to the equations of general relativity, which suggests the theoretical possibility of closed timelike curves. In Brans-Dicke gravitation, attempts to find solutions for spinning cosmic strings always restricted for approximations with an unique form field, previously defined, leading to not very significant scenarios. In this work, we present a model for spinning cosmic strings, developed from the Brans-Dicke theory of gravitation, where the field equations admit a general form. The model consists of a 6 coupled nonlinear differential equations system. The analytical solutions found so far for this system will be shown and an initial discussion on the contribution of these solutions to better understand the dynamics of spinning cosmic strings will be held.

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