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Bouncing Universe in the Contexts of Generalized Cosmic Chaplygin Gas and Variable Modified Chaplygin Gas

The initial singularity in the cosmological models is the big problem in the background of General Relativity (GR). The inflation theories suffer from the initial singularity problem at the origin t = 0. The inflationary cosmology for early-time is consistent but many theoretical inconsistencies of the big bang cosmology had occurred. Inflationary paradigm may resolve several kinds of problems in standard big bang cosmology in the early Universe but the initial singularity cannot be avoided. Since the inflation is described by the dynamics of the scalar fields coupled with the Einstein's gravity, so a new gravitational theory may be required to describe the beginning of the Universe to avoid the initial singularity. Many researchers have attempted to resolve this singularity problem through the generalised/modified general relativity theories. The initial singularity can very well be avoided in frames of non-singular bouncing cosmological models. The key feature of such models is modification of standard Einstein-Hilbert action. The oscillating universe is an alternative to standard big bang cosmology to avoid the big bang singularity by replacing it with a cyclical evolution, which means that the universe was arriving to the Big Bang era after the bouncing and so the equation of state parameter (\omega) should cross from \omega < −1 to \omega > −1.
In this work, we consider the Friedman-Robertson-Walker model of the universe where bounce occurs and the universe is filled with Generalised Cosmic Chaplygin Gas or Variable Modified Chaplygin Gas. Then we study the stability analysis through dynamical system for both models and found the critical points in flat, open and closed universe. In presence of scalar field, we found the dynamical behaviour of scale factor and Hubble parameter in both models. We also analyse the energy conditions for both the models in bouncing universe.

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