

Archimedean-type force in a cosmic dark fluid. III. Big rip, little rip, and cyclic solutions

Balakin A., Bochkarev V.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

We analyze the late-time evolution of the Universe in the framework of the self-consistent model, in which dark matter is influenced by the Archimedean-type force proportional to the four-gradient of the dark energy pressure. Dark energy is considered as a fluid with the equation of state of the relaxation type, which takes into account a retardation of the dark energy response to the Universe's accelerated expansion. Dark matter is guided by the Archimedean-type force, which redistributes the total energy of the dark fluid between its two constituents, dark energy and dark matter, in the course of the Universe's accelerated expansion. We focus on the constraints for the dark energy relaxation time parameter, for the dark energy equation of state parameter, and for the Archimedean-type coupling constants, which guarantee big rip avoidance. In particular, we show that the Archimedean-type coupling protects the Universe from the big rip scenario with asymptotically infinite negative dark energy pressure, and that the little rip is the fate of the Universe with the Archimedean-type interaction inside the dark fluid. © 2013 American Physical Society.

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