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Non-Conserved Gravity: A Thermodynamic Origin of Cosmic Acceleration

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We present a new gravitational framework in which the conventional conservation of the energy-momentum tensor is relaxed and replaced by a non-conservation law motivated by relativistic thermodynamics. In this approach, the exchange of energy and momentum between matter and the gravitational sector is treated as a fundamental physical effect rather than as an effective description of an unknown dark-energy component. The resulting field equations extend Einstein gravity while retaining the standard geometric description of spacetime and the usual conservation law as a limiting case.

We investigate the cosmological consequences of this non-conserved gravitational dynamics in a homogeneous and isotropic universe. The modified continuity equation introduces an additional matter-spacetime exchange term, which changes the evolution of the cosmic energy density and generates an effective contribution to the expansion dynamics. Remarkably, the resulting cosmological evolution can produce a transition from decelerated to accelerated expansion without introducing a fundamental cosmological constant or an exotic dark-energy fluid. For suitable parameters, the background evolution approaches the behavior of the standard Λ CDM model while providing a different physical interpretation of the source of late-time acceleration.

The framework therefore offers a thermodynamically motivated alternative to the conventional dark-energy picture and provides a direct connection between gravitational dynamics, energy exchange, and cosmological evolution. We discuss the corresponding expansion history and the prospects for confronting the model with observational cosmology, including distance-redshift measurements and the evolution of the Hubble parameter. The results suggest that violations of energy-momentum conservation, when consistently incorporated into gravitational thermodynamics, may provide a viable route toward understanding cosmic acceleration without requiring an independent dark-energy sector.

Primary author(s) : Mr. FAZLOLLAHI, Seyed Hamidreza (RUDN)

Presenter(s) : Mr. FAZLOLLAHI, Seyed Hamidreza (RUDN)

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