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Stasis in an Expanding Universe: A Recipe for Stable Mixed-Component Cosmological Eras

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One signature of an expanding universe is the time-variation of the cosmological abundances of its different components. For example, a radiation-dominated universe inevitably gives way to a matter-dominated universe, and critical moments such as matter-radiation equality are fleeting. In this talk, we point out that this lore is not always correct, and that it is possible to obtain a form of "stasis"in which the relative cosmological abundances Ω_i of the different components remain unchanged over extended cosmological epochs, even as the universe expands. Moreover, we demonstrate that such situations are not fine-tuned, but are actually global attractors within certain cosmological frameworks, with the universe naturally evolving towards such long-lasting periods of stasis for a wide variety of initial conditions. The existence of this kind of stasis therefore gives rise to a host of new theoretical possibilities across the entire cosmological timeline, ranging from potential implications for primordial density perturbations, dark-matter production, and structure formation all the way to early reheating, early matter-dominated eras, and even the age of the universe.

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