

Multi-dimensional cosmology and GUP

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Abstract. We consider a multidimensional cosmological model with FRW type metric having 4-dimensional space-time and d -dimensional Ricci-flat internal space sectors with a higher dimensional cosmological constant. We study the classical cosmology in commutative and GUP cases and obtain the corresponding exact solutions for negative and positive cosmological constants. It is shown that for negative cosmological constant, the commutative and GUP cases result in finite size universes with smaller size and longer ages, and larger size and shorter age, respectively. For positive cosmological constant, the commutative and GUP cases result in infinite size universes having late time accelerating behavior in good agreement with current observations. The accelerating phase starts in the GUP case sooner than the commutative case. In both commutative and GUP cases, and for both negative and positive cosmological constants, the internal space is stabilized to the sub-Planck size, at least within the present age of the universe. Then, we study the quantum cosmology by deriving the Wheeler-DeWitt equation, and obtain the exact solutions in the commutative case and the perturbative solutions in GUP case, to first order in the GUP small parameter, for both negative and positive cosmological constants. It is shown that good correspondence exists between the classical and quantum solutions.

Keywords: cosmology with extra dimensions, quantum cosmology