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Emergent Cosmology, Inflation and Dark Energy from SSB of Scale Invariance

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A new class of gravity-matter models defined in terms of two independent non-Riemannian volume forms (alternative generally covariant integration measure densities) on the space-time manifold are studied in some detail. These models involve an additional R^2 (square of the scalar curvature) term as well as scalar matter field potentials of appropriate form so that the pertinent action is invariant under global Weyl-scale symmetry. Scale invariance is spontaneously broken upon integration of the equations of motion for the auxiliary volume-form degrees of freedom. After performing transition to the physical Einstein frame we obtain: (i) An effective potential for the scalar field with two flat regions which allows for a unified description of both early universe inflation as well as of present dark energy epoch; (ii) For a definite parameter range the model possesses a non-singular “emergent universe” solution which describes an initial phase of evolution that precedes the inflationary phase; (iii) For a reasonable choice of the parameters the present model conforms to the Planck Collaboration data.

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