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Wormholes in a Friedmann Universe

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We consider the generalized Tolman solution of general relativity, describing the evolution of a spherical dust cloud in the presence of an external electric or magnetic field. In such models, we study the possible existence of wormhole throats defined as spheres of minimum radius at a fixed time instant, and prove the existence of throats in the elliptic branch under certain conditions imposed on the arbitrary functions that are present in the solution. It is further shown that such dust clouds with throats can be inscribed into closed isotropic cosmological models filled with dust to form wormholes which exist for a finite period of time and experience expansion and contraction together with the corresponding cosmology. Explicit examples and numerical estimates are presented.

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