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Formation and evolution of complex soliton structures in the early Universe

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The formation of composite solitons produced by scalar fields without thermal phase transitions in the early Universe is considered. We present numerical simulations of the formation and evolution of soliton structures at the post-inflationary stage. The realistic initial conditions are obtained through the simulation of multiple quantum fluctuations during the inflation epoch. The initial field distributions allow to form local soliton clusters in the early Universe without the need for the thermal production of a soliton network throughout the Universe. We find that in three-dimensional space, the nontrivial composite field structures are formed in the form of soliton foam, consisting of closed domain walls, domain walls bounded by cosmic strings, and scalar field radiation. The possible cosmological implications of the soliton foam are discussed.

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