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String mechanism for mass generation in a gas of thin tubes of a massless scalar field

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The gas of thin tubes of a massless scalar field (TToMSF) could have been formed at the earliest stages of the evolution of the Universe and, as a result, could have influenced all processes in its evolution. The feature of TToMSF gas is that the parameter of the equation of state of such a gas depends on the density of the gas. As a result, local equations of state can be realized in TToMSF gas; this may alleviate tensions within the standard cosmological model associated with the inhomogeneity of structure growth in the Universe and the significantly higher inhomogeneity of the observed Universe. At the same time, the gravitational interaction between individual TToMSFs in the gas can lead to the generation of particles with an effective non-zero rest mass, which, taken together, allows us to classify the TToMSF gas not only as a dynamical dark energy model, but also as a unified dark fluid model. In this work, we investigated possible trajectories of a test null string in the gravitational field of an early'' thin closed tube of a massless scalar field that radially increases or decreases its size. We have shown that the test null string experiences astrong" gravitational attraction at each segment of its trajectory, which is capable of changing the nature of the motion of the test null string to the opposite. This feature of interaction may indicate the possibility of realizing a scenario of long-term self-consistent motion of two closed TToMSFs within a spatially limited region. At the same time, such gravitating systems can be interpreted as particles with an effective non-zero rest mass.

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