



Contribution ID : 306

Type : Poster

A gas of null strings in the early and late Universe: from local dynamics to accelerated expansion

Tuesday, 27 October 2026 19:25 (5)

Modern analysis of data from early- and late-epoch cosmological probes has revealed statistically significant tensions between predictions for different stages of the Universe's evolution. Key among them are the discrepancies in the determination of the Hubble constant H_0 and the parameter S_8 , which characterizes the amplitude of matter density fluctuations. One of the most promising ways to resolve these contradictions is the concept of dynamical dark energy, moderate observational indications of whose existence are contained in the recent DESI BAO DR2 data release. The gas of thin tubes of a massless scalar field also belongs to the class of dynamical dark energy models, since the parameter w of its equation of state is a dynamical function of the density. In this work, we investigated the influence of the evolution of the gravitational field of a single closed thin tube of a massless scalar field, radially changing its size, on the trajectories of a test null string. We also investigated how constraints on the trajectories of test objects can macroscopically influence the dynamics of the accelerated expansion of the entire gas of thin tubes on cosmological scales.

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Session Classification : Poster session

Track Classification : Gravitation and cosmology