
MAGIC

Science of the Cosmos

Contribution ID: 62

Type: **not specified**

Why pressure fails as the matter Lagrangian of an ideal fluid

In this work, we demonstrate that identifying the matter Lagrangian with the pressure leads to physical inconsistencies, which are resolved when the fluid is coupled to the gravitational field. In such a scenario, the matter Lagrangian necessarily assumes the value of the total energy density. We thus conclude that, for an ideal fluid, the only physically consistent choice for the matter Lagrangian is its total energy density.

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