

Axion as a cold dark matter candidate: Proof to fully nonlinear perturbation

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We present a proof of the axion as a cold dark matter candidate to the fully nonlinear and exact perturbations based on Einstein's gravity. We consider the axion as a coherently oscillating massive classical scalar field. We show that the axion has a characteristic pressure and anisotropic stress. But these terms do not affect the hydrodynamic equations in our axion treatment. The pressure term is negligible in the super-Jeans scale which is of the solar-system scale for conventional axion mass. As the fully nonlinear and relativistic hydrodynamic equations for an axion fluid coincide exactly with the ones of a zero-pressure fluid in the super-Jeans scale, we have proved the cold dark matter nature in that scale.

Summary

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