Entropy Model for lambda-Dark Matter with Hidden Sector

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Abstract

This theoretical framework shows an entropy model of FRW universe and describes the behaviour of Lambda-CDM. The possibility that the Dark photon in a hidden sector is a Maxwell demon.

Introduction

Dark Matter is a mystery in Physics that is invisible mass and not interacts with electromagnetism and only feels gravity. Dark electromagnetism ($\Upsilon_{e\text{-}m}$) is a hidden sector and it's not a part of visible matter Standard Matter and it's a new gauge force search beyond Standard Model. ∧CDM behaves as Bose Einstein Condensate superfluid so the entropy is depends on critical density and dark electromagnetism is a hidden sector that links Standard Model and Dark Mater. Dark photons is a Maxwell demon that links visible matter (SM) and dark sector. The $\Upsilon_{e\text{-}m}$ is a hidden sector the extra force between gauge group of visible sector and dark matter is dark photon as a Maxwell demon

Entropical FRW universe

The entropy of the universe is always increases as the arrow of the time is pointing towards future. $S=K_B \ln\Omega$ is the entropy for microscopic system in statistical physics so compare with BH entropy $S_{BH}=4\pi K_B G M^2_{BH} / \hbar c$ Black hole is the reverse process of big bang and the singularity plays a major for these symmetry. The entropy is null during at the point of singularity in big bang. As entropy increases the universe accelerates and expands, the Hubble effect is due to the critical density of the universe.

$$H = \frac{\dot{a}(t)}{a(t)} \quad \text{Hubble effect } \frac{\dot{a}^2(t)}{a^2(t)} = \frac{8\pi G}{3}\Sigma\,(t) - \frac{k}{a^2(t)} \tag{1}$$

FRW equation in entropy with Hubble constant is the dynamics of the universe. ∧CDM behaves as a BEC superfluid ~10^{-22} eV with zero viscosity and chapgylin gas is an exotic gas might be dark energy responsible for expansion of the universe. If the star collapses due to the degeneracy pressure then the radius decreases and mass increases from scharwzchild radius. ∧CDM as Bose Einstein Condensate is a non-relativistic to solve dark matter halo cusp problem by Gross Pitaevskii equation.

Density distribution is $\rho_{DM}(r) = = \rho_{DM} \frac{\sin kr}{kr}$ (2)

Where k is a central density condensate $k = \sqrt{Gm^3\hbar a}$

Mass of dark matter is $m_{DM} = \frac{4}{\pi} R^3 \rho_{DM} R_{DM}$ (3)

The halo is produced if m~$\frac{1eV}{c^2}$ and the gravitational interactions thermalize ∧CDM and the axions to form Bose Einstein condensate. Chaplygin gas is an asymptotically negative pressure fluid.

Equation of state is $p = -\frac{A}{\rho}$ (4)

Where ρ is a relativistic form of conservation fluid in FRW and the mediator between visible sector and dark matter is hidden sector and its consists of $\Upsilon_{e\text{-}m}$ by kinetic mixing.

Flowchart & pictorial

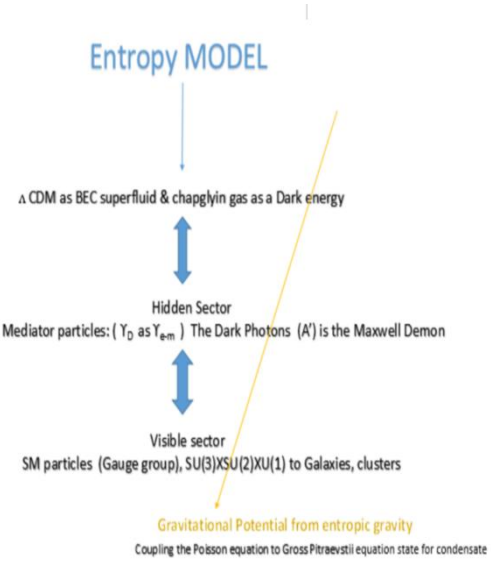

Figure (1)

In Fig (2) The Entropy model arises from the concept here that lambda-CDM behaves as Bose Einstein's Condensate and chapglyin gas (exotic gas) as a dark energy which is responsible for the expansion of the universe. Here in the case the dark photons are the mediator particles that they mediates the visible sector and dark sector. Here we considered the Maxwell demon as a mediator between the gauge group SU (3) xSU (2) xSU (3)

Figure (2)

Fig (2) shows about the clear pictorial how the mediator as a Maxwell demon in Υ_{e-m} between Standard model gauge group and dark matter

Conclusion

The dark photon is a Maxwell demon in a hidden sector that behaves as a mediator between visible sector and dark matter. Entropy of lambda- CDM is depends on both the Hubble effect and SM gauge group the lambda-CDM behaves as a Bose Einstein Condensate superfluid.

References

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2. J.C. Fabris, S.V.B. Gon_calves e P.E. de Souza, *Mass power spectrum in a Universe dominated by the Chaplygin gas*, astro-ph/0203441;