## MAGIC23 Workshop (Matter, Astrophysics, Gravitation, Ions and Cosmology)



Contribution ID: 19

Type: Oral

## Massive particle pair production and oscillation in Friedman Universe: its effect on inflation

We study the classical Friedman equations for the time-varying cosmological term  $\tilde{\Lambda}$ 

and Hubble function H, together with quantised field equations for the production of massive  $M \gg H$  particles, namely, the  $\tilde{\Lambda}$ CDM scenario of dark energy and matter interactions. Classical slow components  $\mathcal{O}(H^{-1})$  are separated from quantum fast components  $\mathcal{O}(M^{-1})$ . The former obeys the Friedman equations, and the latter obeys a set of nonlinear differential equations. Numerically solving equations

for quantum fast components, we find the production and oscillation of massive

particle-antiparticle pairs in microscopic time scale  $\mathcal{O}(M^{-1})$ . Their density and pressure averages over microscopic time do not vanish.

It implies the formation of a massive pair plasma state in macroscopic time scale  $\mathcal{O}(H^{-1})$ , whose effective density and pressure contribute to the Friedman equations. Considering the inflation driven by the time-varying cosmological term and slowed down by the massive pair plasma state, we obtain the relation of spectral index and tensor-to-scalar ratio in agreement with recent observations. We discuss the singularity-free

pre-inflation, the CMB large-scale anomaly, and dark-matter density perturbations imprinting on power spectra.

Author: XUE, She-Sheng (ICRANet, and Sapienza University of Rome. Italy)

Presenter: XUE, She-Sheng (ICRANet, and Sapienza University of Rome. Italy)

Track Classification: Cosmology