

## Stochastic Variation of the Hubble's Parameter Using Ornstein-Uhlenbeck Process

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**Abstract :** This paper deals with the fact that the Hubble's parameter is not constant and tends to vary stochastically with time. This premise has been proven by converting it to a stochastic differential equation using the Ornstein-Uhlenbeck process. The formulated stochastic differential equation is further solved analytically using the Euler and the Kolmogorov Forward equations, thereby obtaining the probability density function using the Fourier transformation, thereby proving that the Hubble's parameter varies stochastically. This is further corroborated by simulating the observations using Python and R-software for validation of the premise postulated. We can further draw conclusion that the randomness in forces affecting the white noise can eventually affect the Hubble's Parameter leading to scale invariance and thereby causing stochastic fluctuations in the density and the rate of expansion of the Universe.

**Keywords :** Chapman Kolmogorov forward differential equations, fourier transformation, hubble's parameter, ornstein-uhlenbeck process , stochastic differential equations

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