

The theta process is a stochastic process of number theoretical origin arising from a scaling limit of quadratic Weyl exponential sums. It shares many properties in common with the Brownian motion such as its Hölder continuity, covariance structure, quadratic variation, scaling properties and so on but crucially we show it is not a semimartingale. The theta process can be described as a map on a particular 6 dimensional Lie group along with an automorphic function. As the theta process is not a semimartingale, Itô techniques are not applicable. However, a more modern theory of stochastic calculus known as rough paths theory is applicable. In this talk we discuss the construction a rough path above the theta process. The rough path (iterated integrals) of the theta process are constructed using homogenous dynamics and representation theory, and again can be described in terms of a Lie group and a higher rank automorphic function.