Abstract

Complexity, holography, and geometry are notions that in recent years often appear together, inextricably linked when the dynamics of high energy (and not only) systems are concerned. In this thesis I explore their interplay through the lens of Krylov complexity, a novel measure which has recently attracted the attention of the community. A key feature in this endeavour is the study of the underlying symmetries, which provide a rigorous framework through which these connections become manifest, allowing not only for a deeper understanding of the physical concepts themselves but also for their potential generalization. Starting from the definition of Krylov complexity, an understanding in terms of an associated symmetry algebra naturally emerges, endowing the dynamics of physical systems with a certain degree of universality and additionally with a geometric interpretation. Subsequently, this framework can be further utilized to study other quantities that characterize the dynamics of quantum systems, modified to describe systems with more sophisticated symmetry structures and even applied to the description of the behaviour of quantum systems under different kinds of evolution, such as modular flow.