Optimal paths on scalar field space: potentials & Wasserstein distance

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Abstract

In this talk, motivated by the Swampland Distance Conjecture, we study distances in field space using the framework of Optimal Transport. After a brief introduction to optimal transport theory, I show how the associated optimisation problem naturally leads to a notion of distance in terms of a (generalised) Wasserstein distance between probability distributions over field space. In the absence of dynamical gravity, this relates the transport problem to Hamilton-Jacobi and continuity equations arising from a WKB expansion of a Schrödinger equation associated with the physical configuration. I then present an extension in the presence of dynamical gravity and discuss its properties. The resulting notions of distances are naturally defined on the full configuration space, while an interpretation in terms of a genuine scalar field distance requires additional modifications. I conclude with some applications and examples, and indicate possible implications for different themes within the Swampland program.

Keywords: Swampland Distance Conjecture, Scalar potentials and distances on field space

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