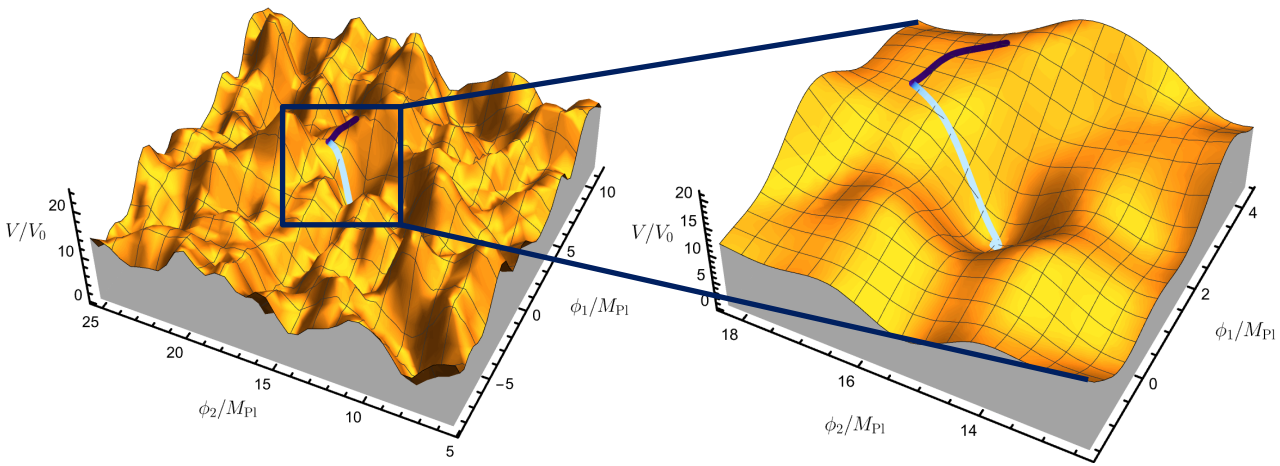
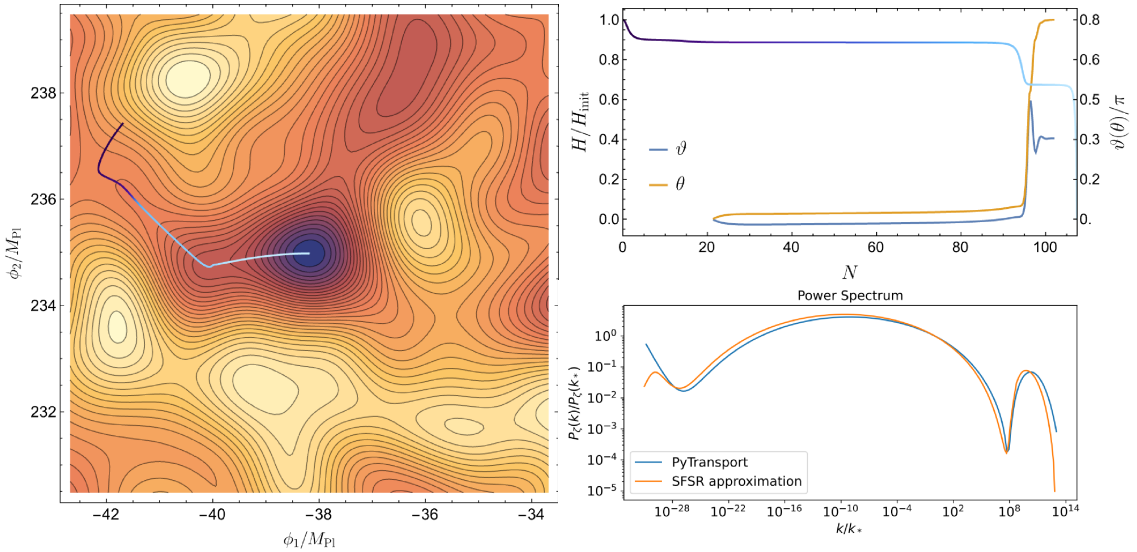




Physics of Inflationary Trajectories on the Landscape

Xingang Chen[1], Lucas Pinol[2], Zhong-Zhi Xianyu[3], Yisong Zhang[2, 3]

[1]Institute for Theory and Computation, Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA

[2]Laboratoire de Physique de l'École Normale Supérieure, ENS, CNRS, Université PSL, Sorbonne Université, Université Paris Cité, F-75005, Paris, France

[3]Department of Physics, Tsinghua University, Beijing 100084, China

Background and Motivations

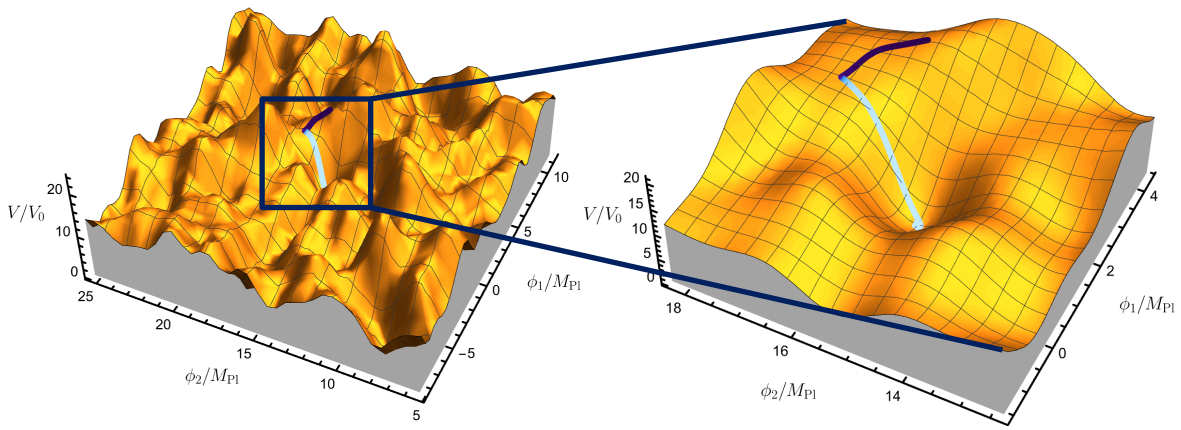
- η-problem in single-field inflation:
  - Slow-roll inflation: $\eta_V \ll 1$
  - Naturally: $\eta_V \sim 1$

$$\eta_V = M_{\rm Pl}^2 \frac{V''}{V}$$

- On the $N_{\rm f}$-dimensional landscape :

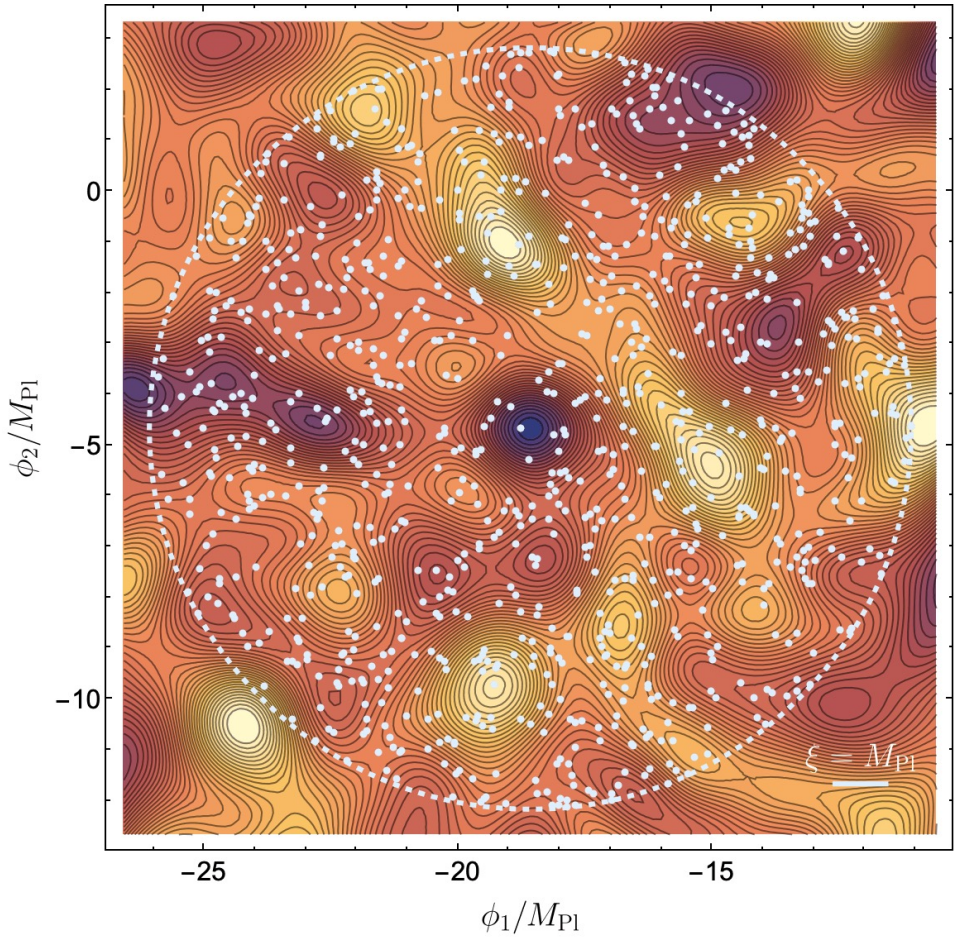
$$\eta_V(\phi) \equiv \frac{M_{\rm Pl}^2}{N_{\rm f}} {\rm Tr}\left[\frac{\partial_I \partial_J V(\phi)}{V(\phi)}\right] = \frac{M_{\rm Pl}^2}{N_{\rm f}} \frac{\nabla^2 V(\phi)}{V(\phi)}$$

  - $\eta_V \sim 1$ statistically
  - Inflation occurs due to cancellations



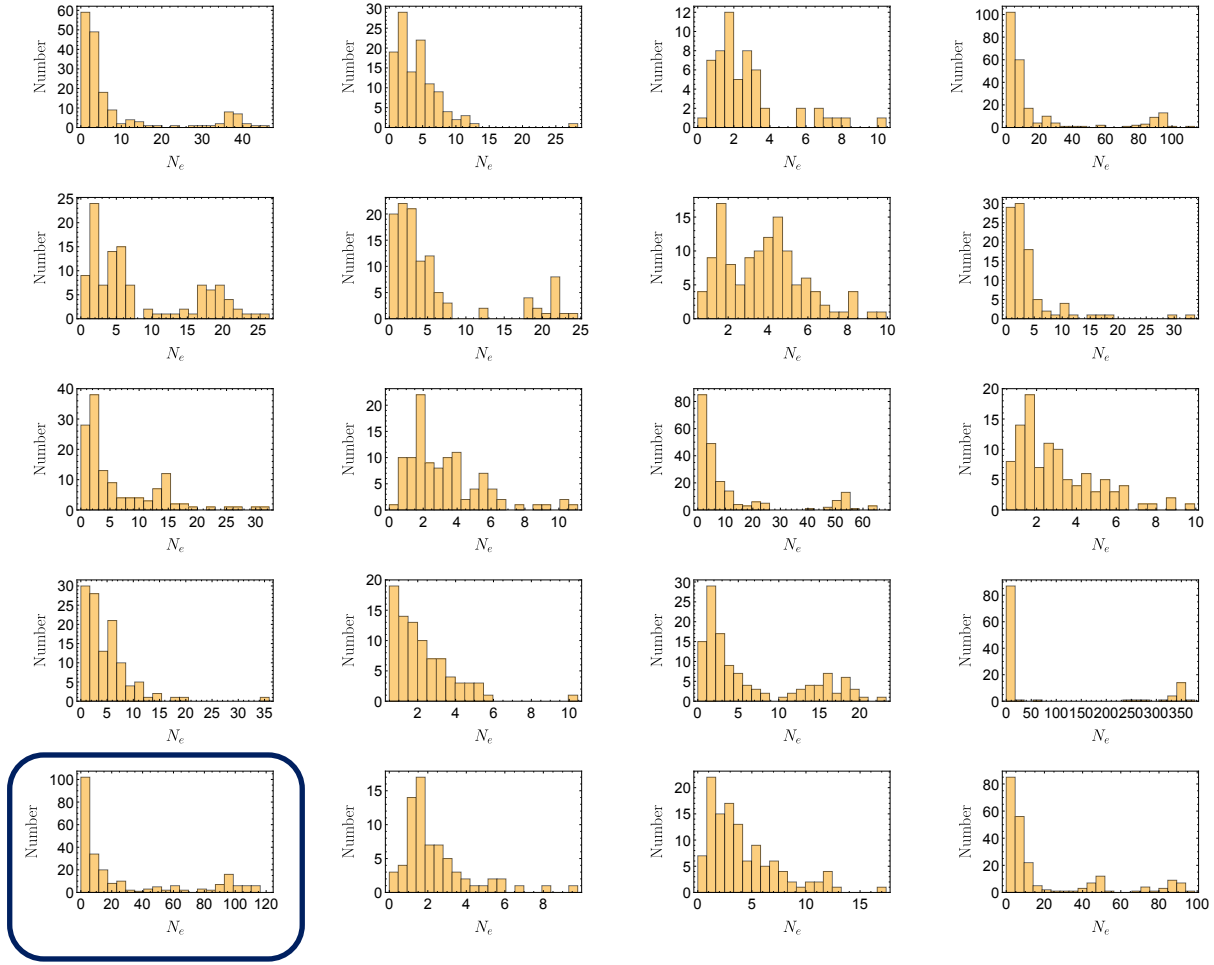
Numerical Setup

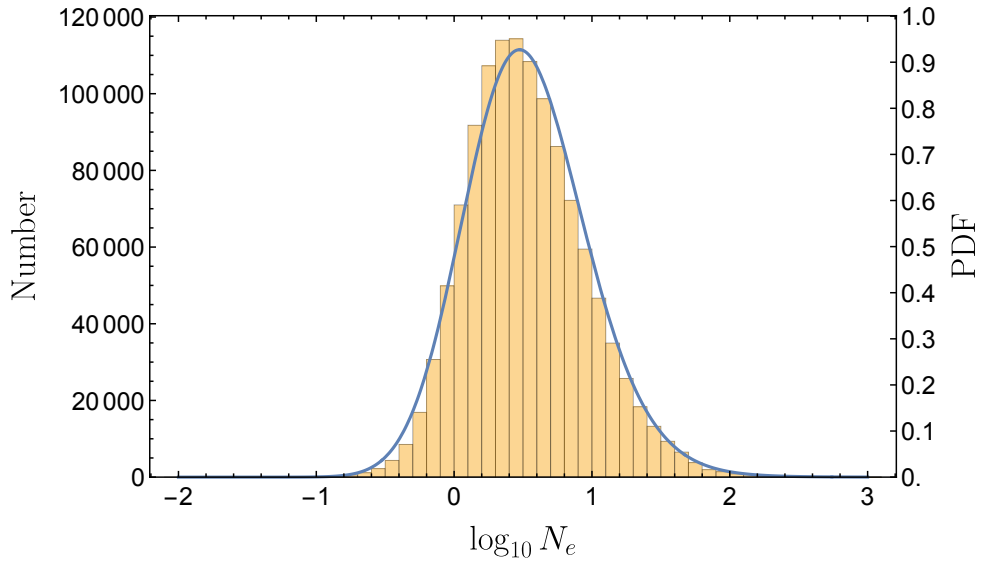
- Field Potential: Random function with correlation length ξ
- $\xi \sim M_{\rm Pl} \rightarrow \eta_V \sim 1$
- Solving EoMs with Random Initial Conditions

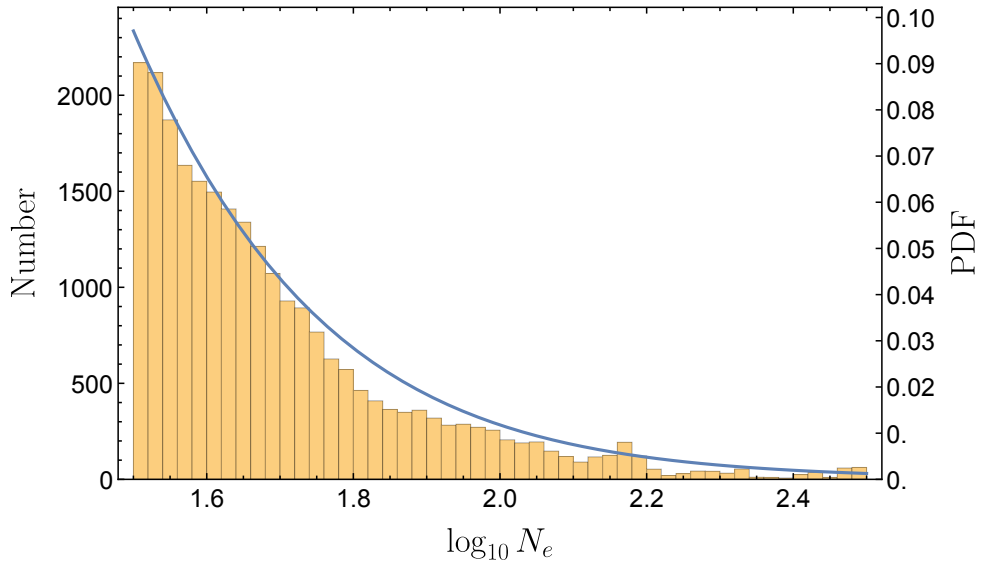


Properties of Inflationary Trajectories for $N_{\rm f} = 2, \xi = M_{\rm Pl}$

Can inflation last long enough on the landscape?

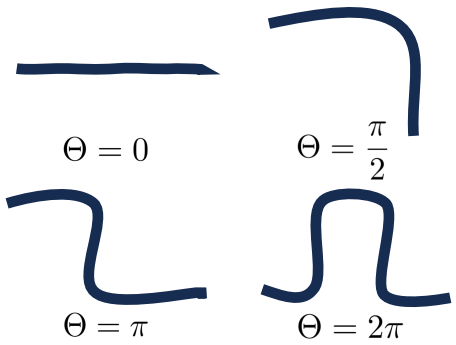


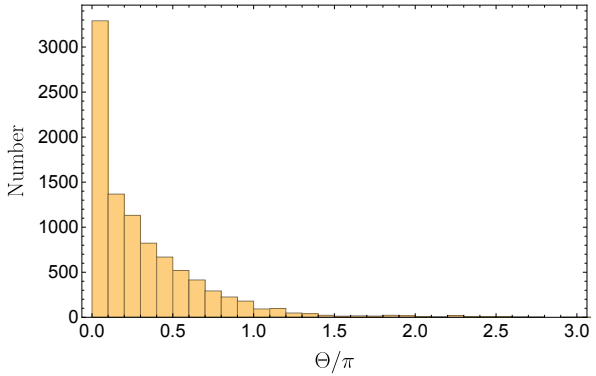




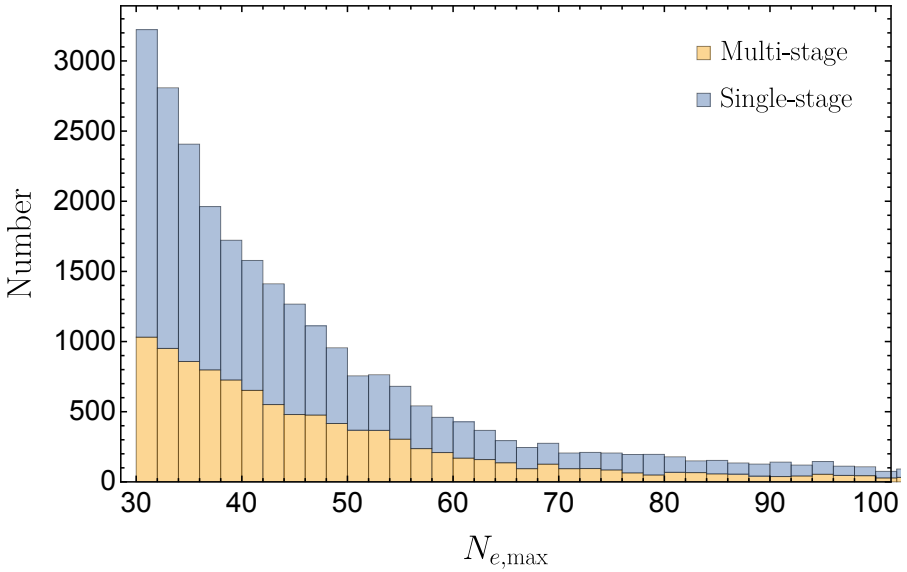
Properties of Inflationary Trajectories for $N_f = 2, \xi = M_{Pl}$

- most trajectories are multi-field

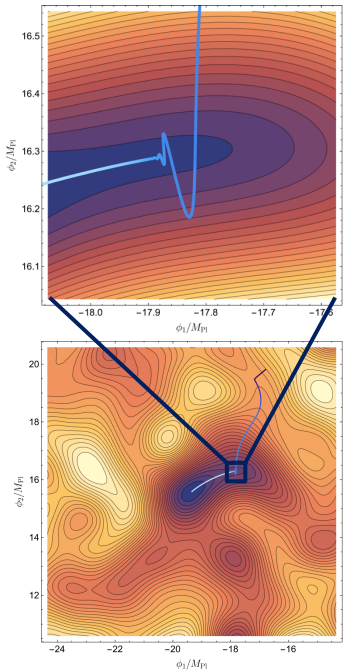


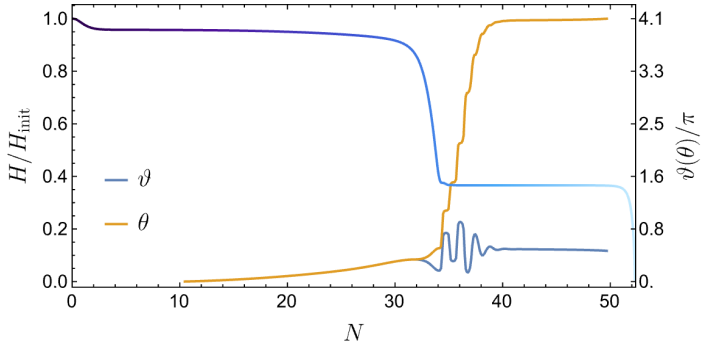


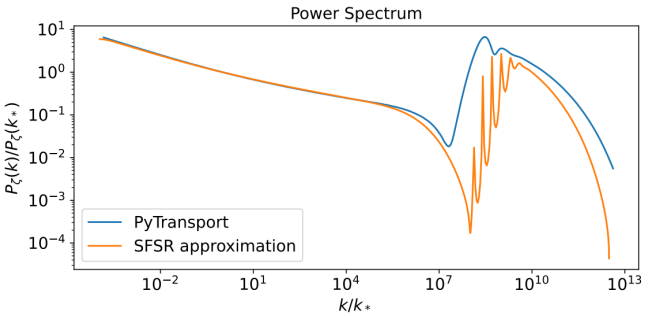
- Half of the trajectories are multi-stage.



- A few trajectories have oscillatory features







- Features are more frequent for larger η_V