

# Weak Gravity and Swampland Conjectures in String Inflation

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The amount of gravitational waves produced during inflation is crucially linked to the distances in field space traversed by the inflaton field. In particular, large primordial tensor modes require field displacements larger than the Planck scale. This is the scenario of Large Field Inflation (LFI). As we await the final observational verdict on this class of realizations, it is important to understand whether transplanckian field values violate general properties of Quantum Gravity. The Weak Gravity Conjecture (WGC) aims at capturing implications of Quantum Gravity for Effective Field Theory (EFT), thus represents a promising tool to address the theoretical consistency of LFI.

In the first part we will give an introduction to the swampland program which tries to identify the criteria that low energy effective field theories ought to satisfy in order to couple consistently with quantum gravity. We will enumerate the known swampland conjectures offering arguments to support them as well as some examples drawn from string theory where these conjectures are satisfied. A lot of attention will be devoted to the Weak Gravity Conjecture and its various formulations.

In the second part we focus on the consequences of the WGC for models of Large Field Inflation. We start by introducing the basic problems of Large Field Inflation in EFT and thus motivate axions as inflaton candidates. We then review general constraints on axion inflation based on an appropriately generalized WGC. We also discuss constraints on setups based on string compactifications. We then specify to two subclasses of string-motivated models: Axion Alignment and Axion Monodromy. We focus on stringy realizations and discuss interpretations of the WGC in terms of the geometry of the extra dimensions and moduli stabilization.

## Bibliography.

- Some constraints on effective field theories to couple consistently with quantum gravity have been known for a long while. A recent overview may be found for instance in [1];
- The swampland program was introduced in [2] and expanded in [3];
- The WGC was introduced [4], see also [5] for the generalisation to multiple gauge bosons;
- Applications of the Weak Gravity conjecture to axion inflation were first considered in [6, 7];
- For generic additional constraints to large field inflation see [8].

## References

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