

# Bethe Colloquium

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## The Swampland Program in Quantum Gravity: From Conjectures to Theorems

Which effective field theory can be coupled to gravity in a consistent quantum theory? This fundamental question has triggered considerable recent interest within the so-called Swampland Program. A growing web of conjectured criteria aims to distinguish the Swampland of effective quantum field theories without an ultra-violet completion with gravity from the Landscape of consistent low-energy approximations to quantum gravity. Within the computational framework of string theory, these conjectures can be rigorously tested. I will describe progress in this direction, focusing on two central conjectures, the Weak Gravity Conjecture and the Swampland Distance Conjecture. Its refinement, the Emergent String Conjecture, explains how and why the Weak Gravity Conjecture holds at least in suitable weak coupling limits, thanks to asymptotic properties of the moduli space of string compactifications and the (quasi-)modularity of the elliptic genus of asymptotically tensionless emergent strings. I will focus on compactifications to four dimensions with minimal  $N=1$  supersymmetry.

**Thursday, July 8, 2021, at 16 c.t.**

**Zoom meeting**

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