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The Three Main Pillars of the Swampland

Abstract

Consistency with quantum gravity can impose non-trivial constraints at low energies, even if the Planck scale is at very high energy. The Swampland program aims to determine the constraints that an effective field theory must satisfy to be consistent with a UV embedding in a quantum gravity theory. This has led to new quantum gravity constraints, motivated by black hole physics and string theory, which can be grouped in three main categories. In this talk, I will review these constraints, focusing on recent developments regarding their connections. For instance, the absence of global symmetries can be connected with completeness of the charged spectra, and can be very constraining when combined with supersymmetry, allowing for a classification of the landscape of theories with 16 supercharges. Moreover, the Weak Gravity and Distance conjectures can be connected asymptotically in the moduli space of string compactifications, and motivated from entropy bounds of small black holes. All these Swampland constraints have led to interesting connections with mathematics, which I will remark during the talk.