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String Theory in Greater Paris

Rencontres Théoriciennes

"Supergravité, théorie des cordes et théorie M"

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Timo Weigand

CERN

A Stringy Test of the Weak Gravity Conjecture

Various swampland conjectures have been put forward in the recent literature to characterize general properties of an effective field theory which can be consistently coupled to quantum gravity. String theory as a framework for quantum gravity allows us to put these conjectures to a quantitative test. Among the earliest of these conjectures is the Weak Gravity Conjecture : It postulates the existence of a set of particles in any quantum gauge theory coupled to gravity whose charge-to-mass ratio must exceed that of an extremal black hole. In this talk we will verify this and further swampland conjectures in string theory, focussing for simplicity on string compactifications to six dimensions with 8 supercharges, in the vicinity of the weak coupling point of the gauge theory. Our proof of the Weak Gravity Conjecture near the weak coupling point combines various aspects of the Kahler geometry of complex surfaces, arithmetic properties of weak Jacobi forms and BPS invariants on Calabi-Yau threefolds. Along the way we elucidate the modification of the Weak Gravity Conjecture due to massless scalar fields. We find perfect agreement between the predictions of the modified conjecture and the charge-to-mass ratio of a set of physical stringy non-BPS states in the theory. Their charges span a sublattice of the full charge lattice, whose index we determine geometrically.

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