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Sharp Bounds on the Landscape

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Recently, it has become increasingly clear that there are constraints on the low-energy effective theories of quantum gravity that cannot be captured by the standard Wilsonian paradigm. For gravitational theories in asymptotically anti-de Sitter spacetimes, we can formulate such constraints and aim to prove or falsify them using the AdS/CFT correspondence. I will review recent progress in this approach and present my proof with Yifan Wang of a part of the Distance Conjecture that I proposed with Cumrun Vafa in 2006. In three spacetime dimensions, we proved that the emergence of an infinite tower of exponentially light particles is inevitable when a moduli field rolls beyond the Planck scale.

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