

Explaining the simplicity of the cosmos

Prof. Neil Turok

School of Physics and Astronomy, University of Edinburgh

Observations of the cosmos on the largest visible scales have revealed it to be amazingly simple. Likewise, the Large Hadron Collider has found no new particles on the tiniest scales probed. In contrast, the most popular theoretical paradigms including string theory and inflation, have grown increasingly complex and contrived. We have therefore launched a search for more economical and predictive explanations. In the process, we stumbled upon 1) the simplest-yet explanation for the cosmic dark matter, soon to be tested by galaxy surveys, 2) a thermodynamic explanation for the large scale geometry of the cosmos, based on an elegant new calculation of gravitational entropy, 3) an explanation of the big bang singularity as a kind of “mirror” which enforces CPT symmetry (the deepest known symmetry of nature, linking particles to antiparticles), and 4) a new explanation of the primordial density variations which led to the formation of galaxies, explaining them quantitatively in terms of known physics. I'll outline the new theory's main challenges and opportunities, ranging from understanding the Higgs boson to consistently coupling the quantum fields of the Standard Model to gravity, as well as future observational tests.