

A String Landscape Perspective on Naturalness

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It is an old idea that we may live in a multiverse. The fundamental parameters we observe in our local universe are then, at least to some extent, accidental. More recently, technical progress in superstring theory, which is arguably the leading candidate for a theory of quantum gravity, has given strong support to this idea. Concretely, the crucial progress came with the discovery of a very large set of effectively 4-dimensional solutions of the 10-dimensional superstring, the so-called “String Theory Landscape”. Moreover, the dynamical mechanism of Eternal Cosmological Inflation is apparently capable of populating the above Landscape. This provides a very concrete, technical realization of the multiverse. Obviously, such a scenario has direct implications for the discussion of naturalness in quantum field theories as they emerge in the low-energy limit of string theory. However, concrete progress is still difficult since, on the one hand, the Landscape is extremely large and complex and our calculational ability limits detailed analyses to small corners of this set of solutions. On the other hand, it turns out to be highly non-trivial, even in principle, to predict where we should expect to find ourselves in this multiverse. This so-called Measure Problem makes it hard to state unambiguously “what is natural” in the Landscape. In my talk, I will attempt to explain the above set ideas in an elementary way and to discuss what a string-theoretic perspective on naturalness or fine-tuning issues in the Standard Model may be.

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