

The Enhance Mechanism in String Theory

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String theory is currently the best candidate we have for a theory of everything, i.e. a theory which unifies gravity with the other three forces that we observe in nature, electromagnetism and the weak and strong nuclear forces. As well as one-dimensional objects, which we call strings, string theory also contains higher-dimensional objects called D-branes. A D-brane is, by definition, a surface on which the end of an open string can lie.

We can consider D-branes with different shapes – in particular we can allow a D-brane to have the geometry of a manifold called K3 (we say the D-brane “wraps” the K3 manifold). In this case the resulting geometry naively contains a singularity in the directions transverse to the D-brane. However, string theory resolves this singularity by a mechanism known as the enhance mechanism. The resulting D-brane object is called an enhance.

There is a generalisation of the enhance geometry, called the nonextremal enhance. There are two forms which the nonextremal enhance can take, known as the horizon branch and the shell branch. For lower energies the only possible option is the shell branch, whereas for higher energies the geometry must take the form of the horizon branch. At intermediate energies some sort of transition between the two branches must take place, however such a transition has not yet been found.