

Computation of Quark Masses in String Theory

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We present a numerical computation, based on neural network techniques, of the physical Yukawa couplings in a heterotic string theory model obtained by compactifying on a smooth Calabi-Yau threefold. We consider one of a large class of heterotic line bundle models which give precisely the MSSM low-energy spectrum plus fields uncharged under the standard-model group. The relevant quantities, that is, the Ricci-flat Calabi-Yau metric, the Hermitian Yang-Mills bundle metrics and the harmonic bundle-valued forms, are all computed by training suitable neural networks. The calculation is carried out at several points along a one-parameter family in complex structure moduli space, and each complete calculation takes about half a day on a laptop. The methods presented here generalise to other string models and constructions, including to F-theory models.

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