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Bootstrapping massive theories in d>=3

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In this work, we extend the conformal bootstrap to include conformal theories deformed by a single mass scale in three or more dimensions. We use the fact that such "mass-deformed" CFTs are dual to regular CFTs in one higher dimension. These have a vast variety of applications in statistical and condensed matter physics- for instance, the Ising model away from criticality, sine Gordon model, bosons and fermions at unitarity, QED, massive large N models, etc. These are obtained from parent CFTs by fixing the momentum along a certain axis- fixing along a light-like direction yields Lifschitz field theories, and along a Euclidean direction yields CFTs deformed by regular mass terms. We then get many useful properties that enable us to bootstrap massive theories-an infinite tower of primaries and descendants encoded in CPWs, massive analogues of conformal blocks and a convergent OPE. In particular we can fix the forms of the scalar and tensor two, three and four-point functions in terms of the OPE coefficients, scaling dimensions of the parent CFT and the deforming mass scale. The conformal block expansion proceeds as usual and in the light-cone limit, we can set up bootstrap equations. We end with some simple analytical solutions to these equations in various limits- large spin, large N and small coupling. This is a first step in the important project of bootstrapping non-conformal theories, and a number of future directions are detailed in the discussion section.

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