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Entanglement entropy of non-unitary quantum field theory

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In this paper we study the simplest massive 1 + 1 dimensional integrable quantum field theory which can be described as a perturbation of a non-unitary minimal conformal field theory: the Lee–Yang model. We are particularly interested in the features of the bi-partite entanglement entropy for this model and on building blocks thereof, namely twist field form factors. Non-unitarity selects out a new type of twist field as the operator whose two-point function (appropriately normalized) yields the entanglement entropy. We compute this two-point function both from a form factor expansion and by means of perturbed conformal field theory. We find good agreement with CFT predictions put forward in a recent work involving the present authors. In particular, our results are consistent with a scaling of the entanglement entropy given by $\frac{c_{\text{eff}}}{3}\log\,\ell$ where c_{eff} is the effective central charge of the theory (a positive number related to the central charge) and ℓ is the size of the region. Furthermore the form factor expansion of twist fields allows us to explore the large region limit of the entanglement entropy and find the next-to-leading order correction to saturation. We find that this correction is very different from its counterpart in unitary models. Whereas in the latter case, it had a form depending only on few parameters of the model (the particle spectrum), it appears to be much more model-dependent for non-unitary models.

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