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Non-unitary multicriticality in two dimensions

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I will present recent developments in the understanding of non-unitary multicriticality in two-dimensions based on JHEP 02 (2023) 046, JHEP 09 (2023) 052 and work in progress.
We study the non-unitary, PT symmetric deformations of the two-dimensional Tricritical Ising Model obtained by coupling its two spin Z2 odd operators to imaginary magnetic fields. We establish the presence of two universality classes of infrared fixed points on the critical surface, separating PT symmetric and PT spontaneously broken phases. The first class corresponds to the familiar Yang-Lee edge singularity, while the second class to its tricritical version. We argue that these two universality classes are controlled by the conformal non-unitary minimal models (2, 5) and (2, 7) respectively, which is supported by considerations based on PT symmetry and the corresponding extension of Zamolodchikov's c-theorem, and also verified numerically using the truncated conformal space approach. Our results are in agreement with a previous numerical study of the lattice version of the Tricritical Ising Model. We also conjecture the classes of universality corresponding to higher non-unitary multicritical points obtained by perturbing the conformal unitary models with imaginary coupling magnetic fields. If correct, it implies the existence of a tower of RG flows among the minimal models (2,2n+3) analogous to the Zamolodchikov's flows among unitary minimal models. Even if they cannot be discussed by using (conformal) perturbation theory and are not integrable flows, we tested the existence of the flows among the minimal models (2,2n+3) numerically, by using truncated conformal space approach in JHEP 09 (2023) 052. We established the existence of the aforementioned flows for critical, tricritical and tetracritical version of the Lee-Yang, making stronger the conjecture on the non-unitary multicritical theory. In the last paper we also observed for the first time some non-critical breaking of PT symmetry. We argue that this exists because of an absence of an order parameter for such a symmetry breaking.

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