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Computing the Central Charge of the 3D Ising CFT Using Quantum Finite Elements

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The 3D Ising conformal field theory (CFT) describes different physical systems, such as uniaxial magnets or fluids, at their critical points. In absence of an analytical solution for the 3D Ising model, the scaling dimensions and operator product expansion (OPE) coefficients characterizing this CFT must be determined numerically. The currently most-cited values for these quantities have been obtained from the conformal bootstrap, while lattice calculations have so far only produced reliable results for the scaling dimensions involved in calculating the critical exponents. Using Quantum Finite Elements to investigate critical ϕ^4-theory on $\mathbb{R}\times\mathbb{S}^2$, we have extracted scaling dimensions and OPE coefficients of the 3D Ising CFT by fitting the lattice four-point function with expectations from the operator product expansion for a radially quantized CFT and extrapolating to the continuum limit. This way, we have for the first time been able to use Monte Carlo simulations to compute the central charge of the theory, as well as scaling dimensions and OPE coefficients of high-spin operators.

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