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Conformal anomaly in spin ladders

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Recent theoretical and experimental advances allow for an observation of signatures of quantum anomalies in condensed matter systems. After a brief discussion of the application of chiral and parity anomalies in condensed matter [1,2], we turn our attention to the conformal anomaly in (1+1)D systems. The conformal anomaly signals itself in a breaking of scale invariance by quantum effects, visible in multi-point functions of the energy-momentum tensor. One way of extracting the conformal anomaly, which we will discuss, is to take the expectation value of the energy-momentum tensor in a thermal state of constant temperature. While this is already connected to the free energy of the system and hence the specific heat, we present here a new application. Using the conformal transformation, we relate the variance of the on-site static magnetization to the conformal anomaly and to the experiments on one dimensional systems. Moreover, we show how the deviations of static magnetization are further modulated in systems with gradient of temperature. We expect that these effects are important in spin chains and spin ladders.

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