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Momentum-space Entanglement Spectrum of Bosons and Fermions with Interactions REX LUNDGREN, JONATHAN BLAIR, University of Texas at Austin, MARTIN GREITER, Insitute for Theoritical Physics, Univesity of Wuerzburg, ANDREAS LAEUCHLI, Institut fuer Theoretische Physik, Universitaet Innsbruck, GREGORY FIETE, University of Texas at Austin, RONNY THOMALE, Insitute for Theoritical Physics, Univesity of Wuerzburg — We study the momentum space entanglement spectra of bosonic and fermionic formulations of the spin-1/2 XXZ chain with analytical methods and exact diagonalization. We investigate the behavior of the entanglement gaps, present in both partitions, across quantum phase transitions in the XXZ chain. In both cases, finite size scaling reveals that the entanglement gap closure does not occur at the physical transition points. For bosons, we find that the entanglement gap observed in [Thomale et al., Phys. Rev. Lett. 105, 116805 (2010)] depends on the scaling dimension of the conformal field theory as varied by the XXZ anisotropy. For fermions, the infinite entanglement gap present at the XX point persists well past the phase transition at the Heisenberg point. We elaborate on how these shifted transition points in the entanglement spectra may in fact support the numerical study of the physical transitions in the momentum space density matrix renormalization group. Accepted by Physical Review Letters (arXiv:1404.7545) This work was supported by an National Science Foundation Graduate Research Fellowship

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