Universal entanglement singularities in quantum critical spin chains

TZU-CHIEH WEI, DYUTIMAN DAS, SWAGATAM MUKHOPADYAY, SMITHA VISHVESHWARA, PAUL M. GOLDBART, University of Illinois at Urbana-Champaign—The entanglement of the quantum XY spin chain in a transverse field is investigated via a recently-developed global measure, applicable to generic quantum many-body systems [1]. This entanglement is determined throughout the phase diagram, and is found to exhibit rich structure [2]. Near the critical line, the entanglement is peaked (albeit analytically), consistent with the notion that entanglement—the non-factorization of wave functions—reflects quantum correlations. Singularity does, however, accompany the critical line, as revealed by the divergence of the field-derivative of the entanglement. The form of this singularity appears to be dictated by the universality class controlling the quantum phase transition.