Bologna Workshop on:
CFT AND INTEGRABLE MODELS
and their applications to Quantum Field Theory, Statistical Mechanics and Condensed Matter Physics

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Excited state entanglement in conformal field theory: extensivity and the role of microscopic detail

Wednesday, September 17, 2014 4:30 PM (30 minutes)

We study the excited state subsystem purity (equivalent to 2nd Renyi entropy) as a measure of entanglement in 1+1d conformal field theories. In order to access the highly excited states we generalize the replica approach and develop a systematic framework to treat arbitrary states (in particular descendants) by means of novel CFT techniques including transformation of descendant fields under conformal mappings and exact evaluation of descendant n-point functions. By examining a number of individual states in the critical Ising and three-state Potts models we uncover a new interesting regime of the subsystem purity as a function of the relative subsystem size: when the subsystems are comparable purity decays exponentially with an exponent depending only on the excitation energy and in a nonlinear way. For the Renyi entropy this translates as a quasi thermodynamic entropy, that is extensive but obeys a nonlinear 1st law analog. As an additional application of the present framework we show preliminary results for ground and excited state Renyi entropies in the massive Ising model using a truncated conformal space approach.
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