Institut Ruđer Bošković
ZAVOD ZA TEORIJSKU FIZIKU
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SEMINAR ZAVODA ZA TEORIJSKU FIZIKU

The Frustration in being Odd: area law violation in local systems

Fabio Franchini
Ruđer Bošković Institute,
Division of Theoretical Physics,
Condensed Matter and Statistical Physics Group

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Abstract:

We demonstrate the existence of a new quantum phase of matter that arises in antiferromagnetic spin chains with a weak frustration -just one bond in a large chain-. This is the case, for instance, of systems with an odd number of spins with periodic boundary conditions. Such new phase is extended, gapless, but not relativistic: the low-energy excitations have a quadratic (Galilean) spectrum. Locally, the correlation functions on the ground state do not show significant deviations compared to the non-frustrated case, but correlators involving a number of sites (or distances) scaling like the system size display new behaviors. In particular, the von Neumann entanglement entropy is found to follow new rules, for which neither area law applies, nor one has a divergence of the entropy with the system size. Such very long-range correlations are novel and of potential technological interest. We display such new phase in a few prototypical chains using numerical simulations and we study analytically the paradigmatic example of the Ising chain. Through these examples we argue that this phase emerges generally in (weakly) frustrated systems with discrete symmetries.

Reference paper
- Salvatore Marco Giampaolo, Flávia Braga Ramos, Fabio Franchini: arXiv:1807.07055

Voditelj seminara:
Andjelo Samsarov
$\langle asamsarov@irb.hr \rangle$