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Bosonisation of one-dimensional fermion systems and applications to spin chains

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Bosonisation is a technique to solve one-dimensional fermion models by transforming them to bosonic systems. S. Coleman (1975) showed that the correlators of the massive Thirring model, a one-dimensional Dirac fermion with self-interactions, coincide with those of the Sine-Gordon boson, and later, S. Mandelstam (1975) found the explicit map between these two systems. The identities found by Mandelstam generalise to a broader set of one-dimensional fermion models, that is, those that can be associated to a boson, and whose properties can hence be studied in an often simpler way by means of this mapping.
The transformation between fermions and bosons, however, is but a particular case of seeking equivalent models to a particular system in order to examine its behaviour in a potentially simpler way. Another example of such transformations is that of Jordan and Wigner (1928), who developed a way to map quantum spin lattices to fermions. This project seeks to examine quantum spin chains under the light of the Jordan-Wigner transformation and a subsequent bosonisation, which in many ways simplify the study of the statistical and thermodynamic behaviour of the chain.

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