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The analytic structure of non-perturbative corrections in integrable field theories

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Several one-dimensional models (both relativistic and non-relativistic) can be solved - at least numerically - by a linear, thermodynamic Bethe ansatz-like integral equation in specific settings. Excellent examples are the nonlinear sigma models in an external field coupled to a conserved charge or the Lieb-Liniger/Gaudin-Yang models for different couplings. In these scenarios, it is possible to perturbatively expand the physical quantities (e.g., the energy density of the particles) in some specific parameter up to very high orders by using the integral equation. This expansion is an asymptotic series that contains lots of hidden analytic information on the exact result. In some cases, this information is complete, and it is possible to reconstruct the exact result from the perturbative series only using resummation techniques. That typically means summing up an infinite number of exponentially suppressed non-perturbative corrections accessible from the perturbative data by resurgence theory. In other cases, there is a mismatch between the exact result and the abovementioned procedure, which can be explained by a careful analysis of the integral equation in Fourier space. One can find the missing family of exponential corrections as well, acquiring a complete understanding of the analytical structure of the physical quantity in terms of the expansion variable, at least from the mathematical point of view. The aim of the talk is a brief summary of this method based on arXiv:2212.09416.

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