

The Critical Properties of a Modulated Quantum sine-Gordon Model

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Abstract: A new procedure of trial variational wave functional is proposed for investigating the mass renormalization and the local structure of the ground state of a one-dimensional quantum sine-Gordon model with linear spatial modulation, whose ground state differs from that without modulation. The phase diagram obtained in parameters $(\alpha\Lambda^{-2}, \beta^2)$ plane shows that the vertical part of the boundary between soliton lattice phase and incommensurate (IC) phase with vanishing gap sticks at $\beta^2=4\pi$, the IC phase can only appear for $\beta^2 \geq 4\pi$ and the IC phase regime is enlarged with increasing spatial modulation in the case of definite parameter $\alpha\Lambda^{-2}$. The transition is of the continuous type on the vertical part of the boundary, while it is of the first order on the boundary for $\beta^2 > 4\pi$.

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Key words: sine-Gordon model, spatial modulation, soliton lattice, incommensurate phase, phase diagram

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