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Abstract

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Chapter 1

Charge Order

1.1 Peierl Transition

1.2 From Causality to Kramer-Kronig relation

Looking at a causal function $\tilde{\chi}(t)$, we can split it, like every analytical function, in an even $\chi_{even}(t)$ and an odd $\chi_{odd}(t)$ part.

$$\tilde{\chi}(t) = \begin{cases} 0 & t < t_0 \\ \chi(t) & t > t_0 \end{cases}$$

$$\tilde{\chi}(t) = \frac{\tilde{\chi}(t) + \tilde{\chi}(-t)}{2} + \frac{\tilde{\chi}(t) - \tilde{\chi}(-t)}{2} = \chi_{even}(t) + \chi_{odd}(t) \tag{1.1}$$

Multiplying the even part of this function with the signum function yields,

$$\mathrm{sign}(t) \cdot \chi_{even} = \mathrm{sign}(t) \cdot \left\{ \frac{\tilde{\chi}(t)}{2} + \frac{\tilde{\chi}(-t)}{2} \right\} = \frac{\tilde{\chi}(t)}{2} - \frac{\tilde{\chi}(t)}{2} = \chi_{odd}(t) \tag{1.2}$$

Using this relation to replace $\chi_{odd}(t)$ in Eq. 1.1 .

$$\tilde{\chi}(t) = \chi_{eve} + \chi_{odd} = (1 + \mathrm{sign}(t)) \cdot \chi_{even}(t) = \sigma(t) \cdot \chi_{even}(t) \tag{1.3}$$

Bibliography