Strong coupling expansion of the t-V model (further results)

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The generalised t-V model [1] of fermions distributed on a chain of $L$ sites with p.b.c.:

$$H = -t \sum_{i=1}^{L} \left( \hat{\phi}_{i}^\dagger \hat{\phi}_{i+1} + \text{h.c.} \right) + \sum_{i=1}^{L} \sum_{m=1}^{p} U_{m} \hat{\phi}_{i+m}^\dagger \hat{\phi}_{i+m}$$

$p$ - interaction range

Away from critical density
- Luttinger liquid
- Highly degenerate ground state
- Interacting "hard rods"

Critical density $Q_{c} = \frac{a}{p+1}$ - $q = 1 - p$
- Mott insulator
- Simple ground state
- "Rods" filling the lattice

The Hamiltonian matrix in new basis:

- [I] Act with $V$
- [II] Separate
- [III] Ortho-normalise
- [IV] Repeat

$\lambda \ll 1, V$ can be treated as a perturbation [3].

For $Q = \frac{1}{p}$ one trivial phase
For $Q = \frac{1}{p}$ phases can be described in detail
For $Q = \frac{1}{p'}$, etc. number of phases increases rapidly; no simple way of description

Possible further work:
- High precision results for both integrable and non-integrable models
- Strong coupling expansion

Strong coupling expansion of the t-V model

Strong coupling expansion

**REFERENCES**