PS-B11

Symmetry protected topological phase of one-dimensional two orbital SU(N) fermionic system

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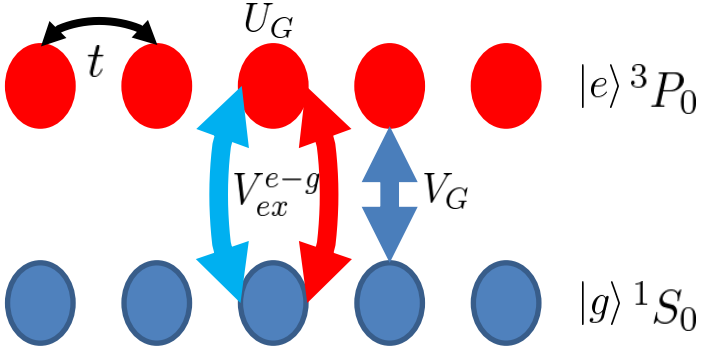
SU(N) fermionic systems using alkaline-earth atoms (^{87}Sr, ^{173}Yb, etc) in optical lattice was realized.

$$H = -t \sum_{\langle i,j \rangle} \sum_{\beta=g,e} \sum_{m=-I}^{I} \left(c^{\dagger}_{i,\beta,m} c_{j,\beta,m} + h.c. \right) - \mu_G \sum_i n_i + \frac{U_G}{2} \sum_i \sum_{\beta=g,e} n_{i,\beta} \left(n_{i,\beta} - 1 \right)$$
$$+ V_G \sum_i n_{i,e} n_{i,g} + V_{ex}^{e-g} \sum_{i,m,m'} c^{\dagger}_{i,g,m} c^{\dagger}_{i,e,m'} c_{i,g,m'} c_{i,e,m}$$

SU(N) symmetry comes from nuclear spin. (N=even)

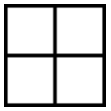


At half-filling, Large U_G, V_G, V_{ex} limit

Second order perturbation for t → SU(N) Heisenberg chain

$$H_{\text{eff}} = K \sum_i \mathbf{S}_i \cdot \mathbf{S}_{i+1}$$

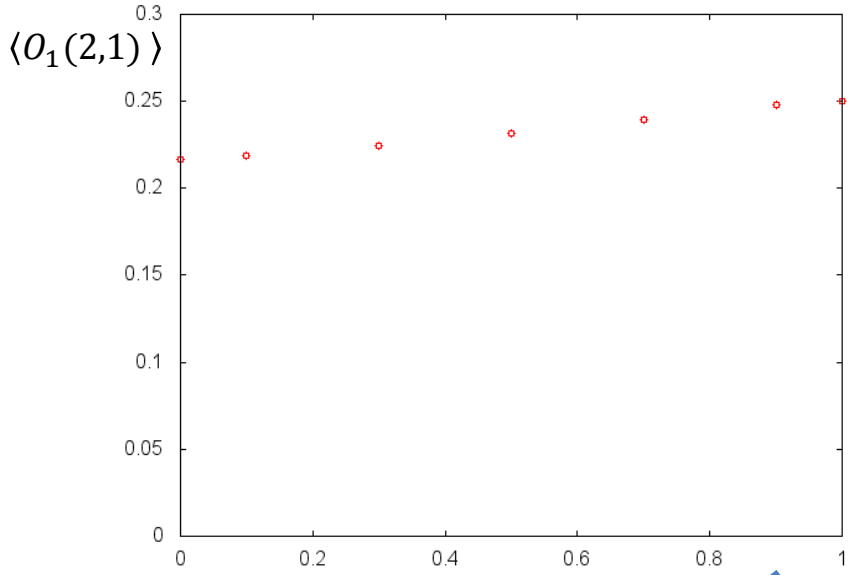
Onsite rep. for $N = 4$ case



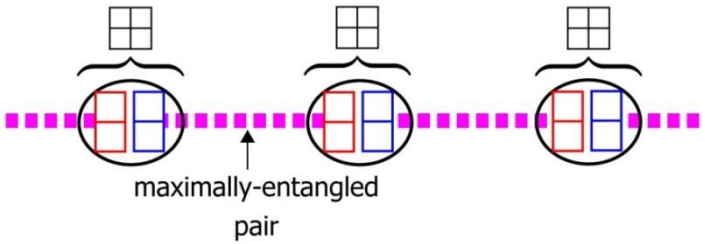
20 dimensional rep.

String order parameter

$$O_1(a,b) = \lim_{|i-j|\to\infty} \{X_P(i)\}^a \exp\left[b\frac{2\pi i}{N}\sum_{i\le k<j} H_k^\rho\right]\{X_P^\dagger(j)\}^a$$



SU(4) Valence Bond Solid state



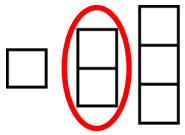
Parent Hamiltonian

$$H_\alpha = \sum_i \{\mathbf{S_i}\cdot\mathbf{S_{i+1}} + a\left[\frac{13}{108}(\mathbf{S_i}\cdot\mathbf{S_{i+1}})^2 + \frac{1}{216}(\mathbf{S_i}\cdot\mathbf{S_{i+1}})^3\right]\}$$

SU(4) Heisenberg

SU(4) VBS

Topological class 2



{0, 1, 2, 3 mod 4}

trivial nontrivial