光格子上における
ボース・ハバードモデルの
分数量子ホール状態

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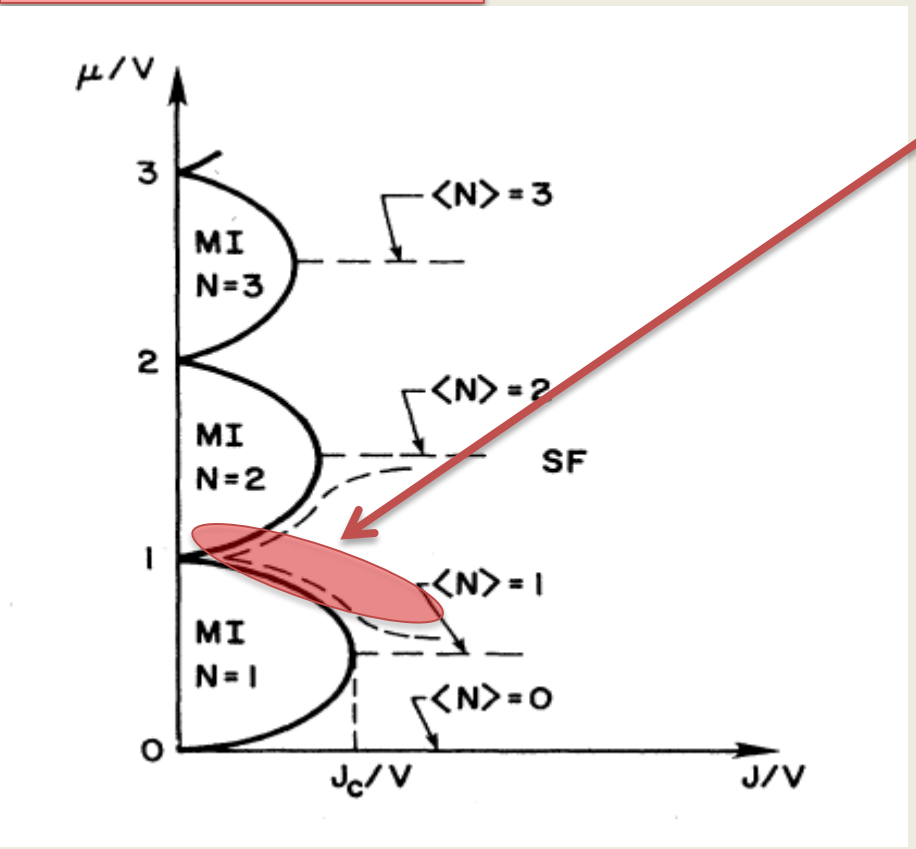
Introduction



M.P.A. Fisher et al., Phys. Rev. B **40**, 546 (1998)

- Strong interaction
- Excess particle dilute

↓

the Fractional quantum hall (FQH) state was predicted by theoretically

Using Gutzwiller ansatz and Chern-Simons theory

We explore close to the Mott phase boundary in strong magnetic field

Model

Harper-Hofstadter Hamiltonian

$$\mathcal{H} = -J \sum_{<ij>} (e^{iA_{ij}} a_i^\dagger a_j + H.c.) + \sum_i \frac{U}{2} n_i(n_i - 1)$$

$$- \sum_i \mu n_i + V \sum_{<ij>} n_i n_j$$

Gutzwiller ansatz

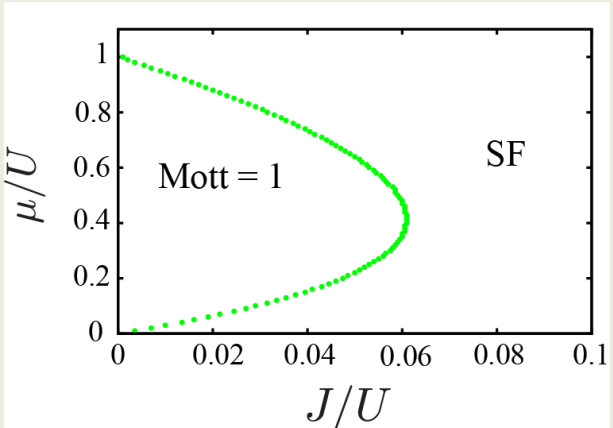
Gutzwiller wave function

$$|\Psi_{MF}\rangle = \prod_{i=1}^{N} \left(\sum_{n=0}^{n_c} f_n^i |n\rangle_i \right)$$

Order parameter

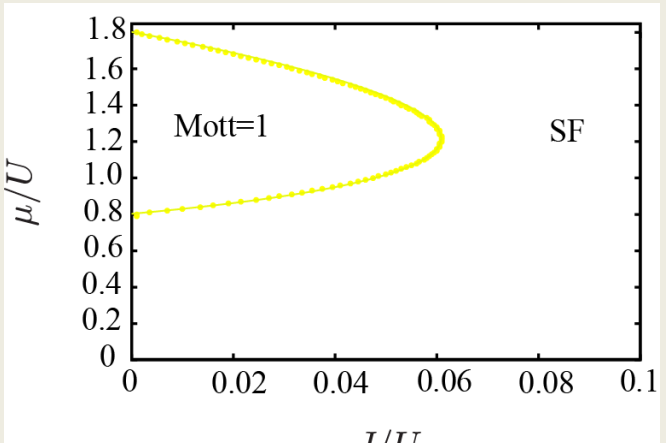
$$\langle a_i \rangle = \Phi_i = \sum_{n=1}^{n_c} \sqrt{n} f_{(n-1)}^{i\,*} f_n^i$$

Phase diagram $V = 0$



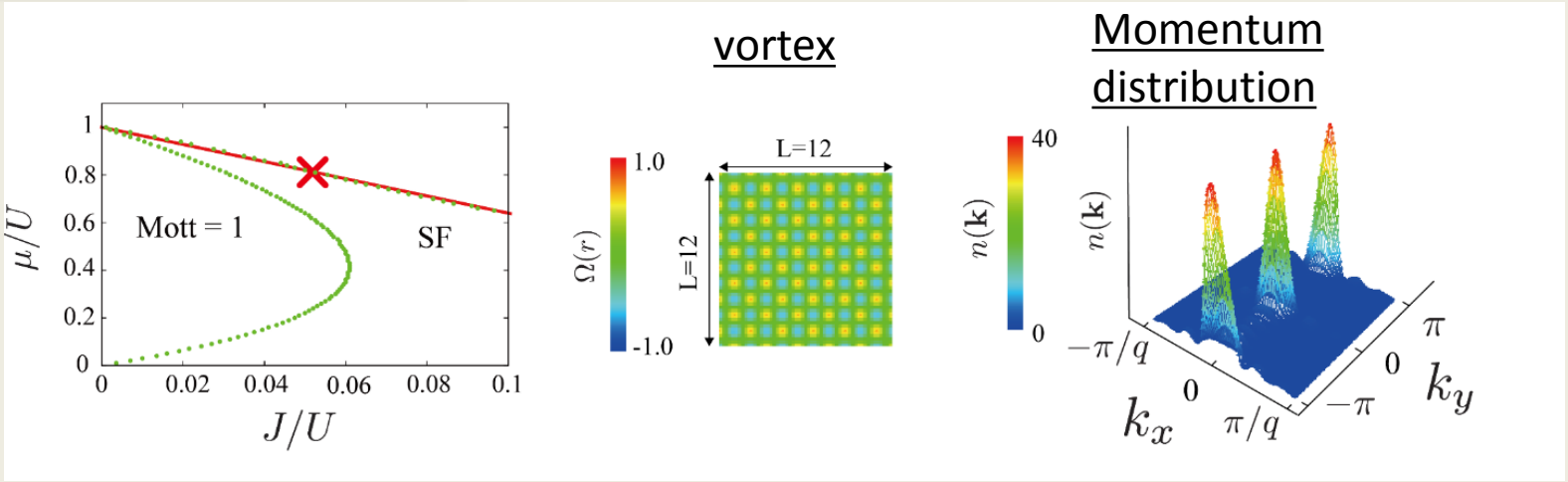
in V

$V = 0.2$



Numerical results

$V = 0$



Nearest-Neighbor interaction $V > 0$??

Exist of Gap ??

Using Chern-Simons theory