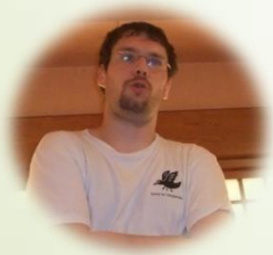


Analysis of correlated topological insulators in one dimension

by Tsuneya Yoshida

Collaborators:



Robert Peters
(RIKEN),



Satoshi Fujimoto
(Osaka Univ.),



Norio Kawakami
(Kyoto Univ.)

[Topological properties]
+
[correlation effects]



Novel phenomena

Purpose

[Topological properties]

+

[correlation effects]



Novel phenomena

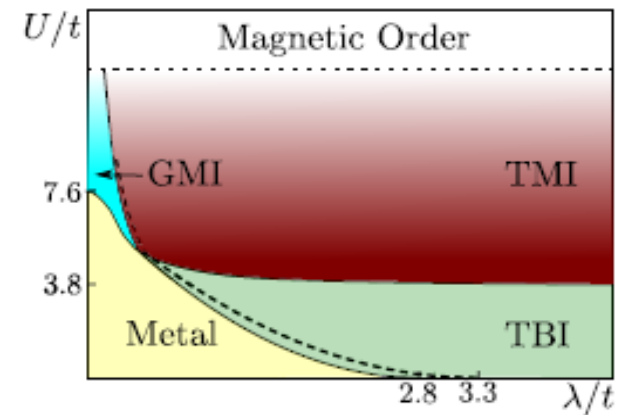
Topological Mott insulators

Edge modes

single particle: gapful

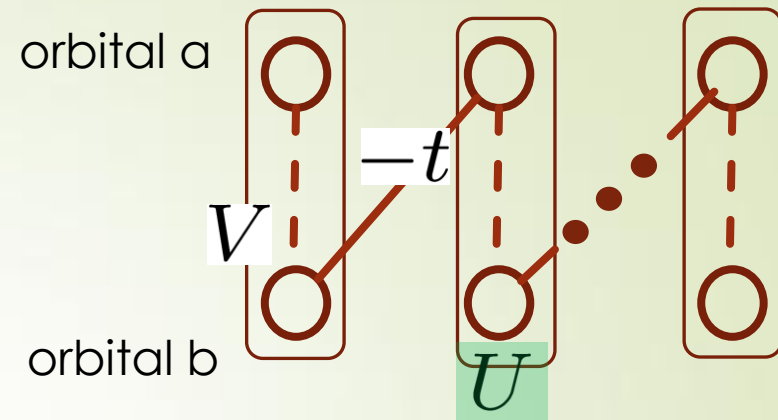
spinon: **gapless, protected.**

DMFT, QMC do not support it.



D.A. Pesin *et al.* (2009)

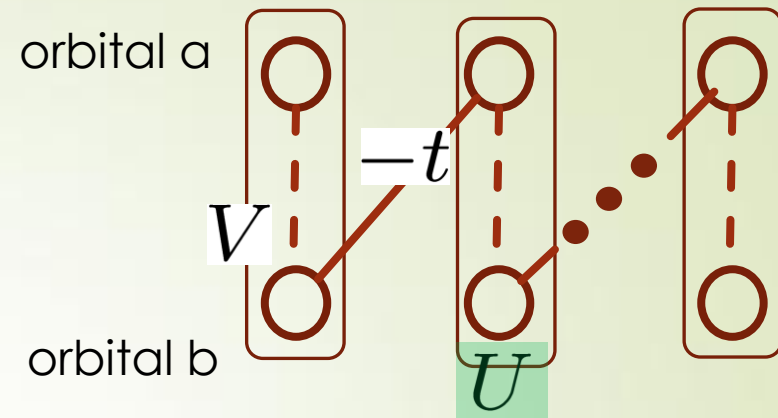
Model (SSH+U)



$$H = H_{SSH} + U \sum_{i\alpha} n_{i\alpha\uparrow} n_{i\alpha\downarrow}$$

$$H_{SSH} = \sum_{i\sigma} (-t c_{i+1a\sigma}^\dagger c_{ib\sigma} + V c_{ia\sigma}^\dagger c_{ib\sigma} + h.c.)$$

Model (SSH+U)

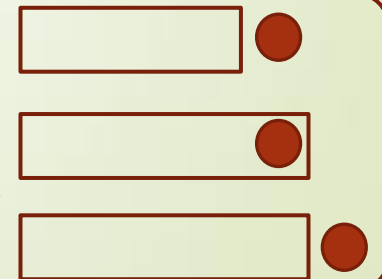


$$H = H_{SSH} + U \sum_{i\alpha} n_{i\alpha\uparrow} n_{i\alpha\downarrow}$$

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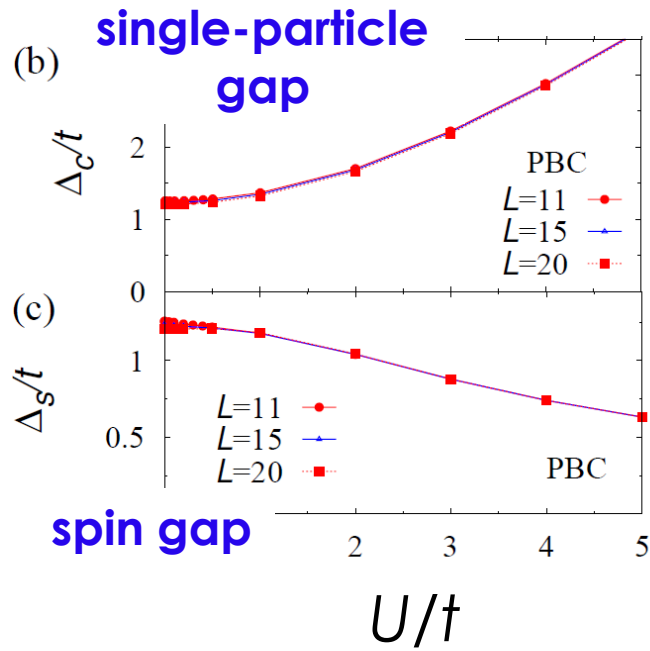
Method: DMRG

Powerful tool for calculation of
ground states, correlation function etc..



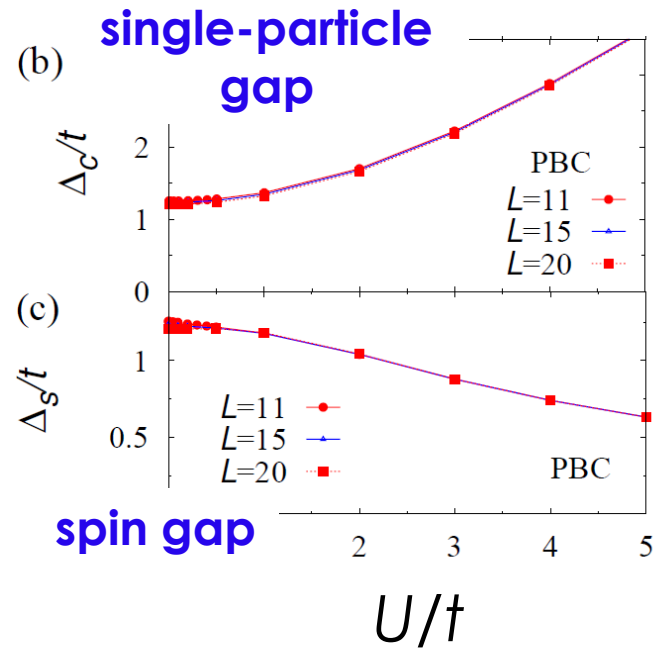
For $V=-0.4/t$, nontrivial at $U=0$.

PBC [bulk]

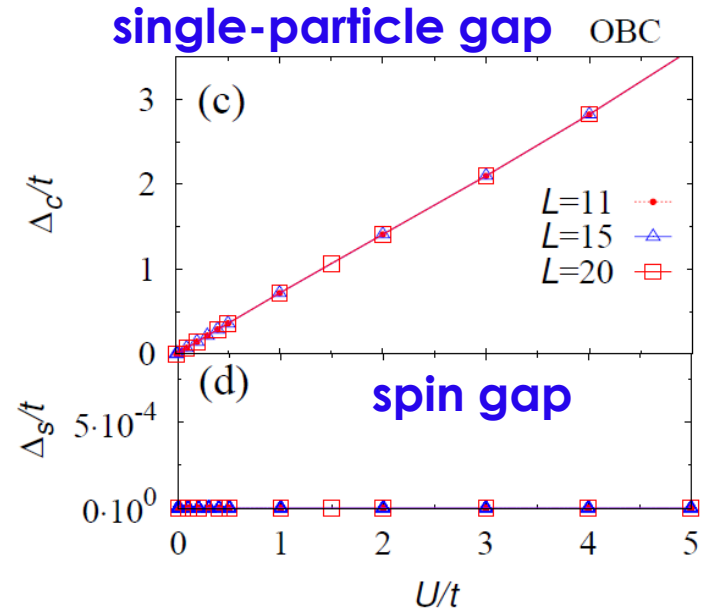


For $V=-0.4/t$, nontrivial at $U=0$.

PBC [bulk]



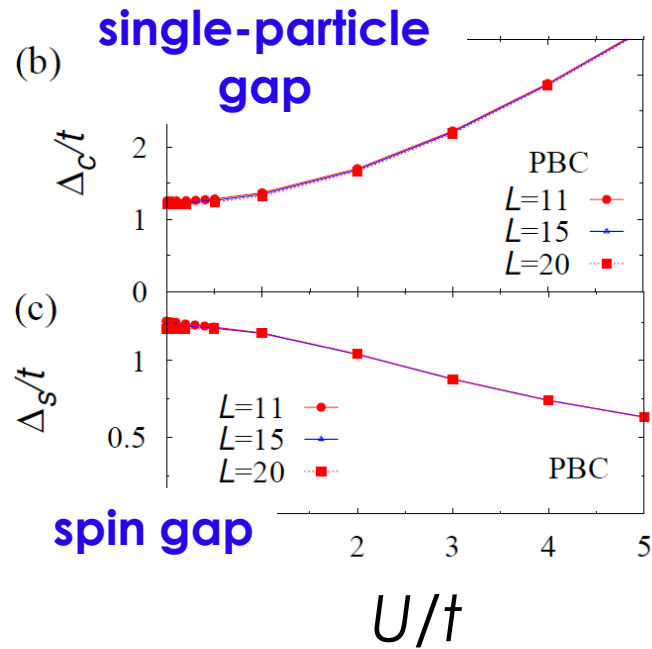
OBC [edge(+bulk)]



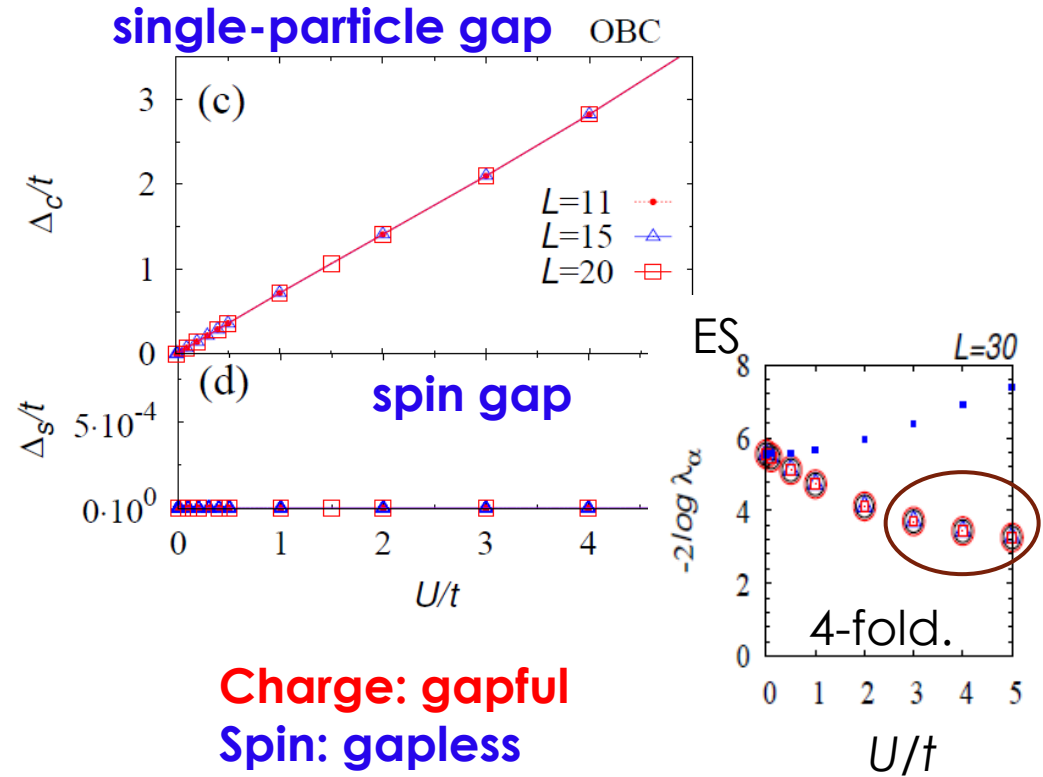
Charge: gapful
Spin: gapless

For $V=-0.4/t$, nontrivial at $U=0$.

PBC [bulk]



OBC [edge(+bulk)]

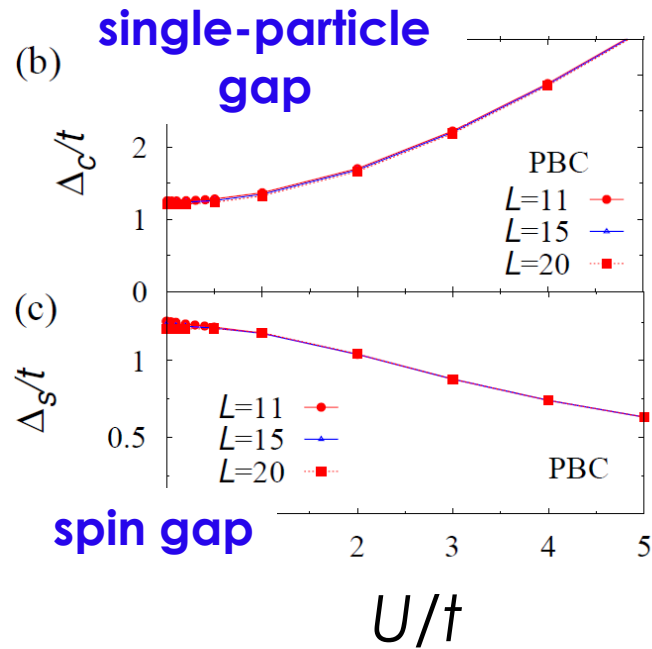


Charge: gapful
Spin: gapless

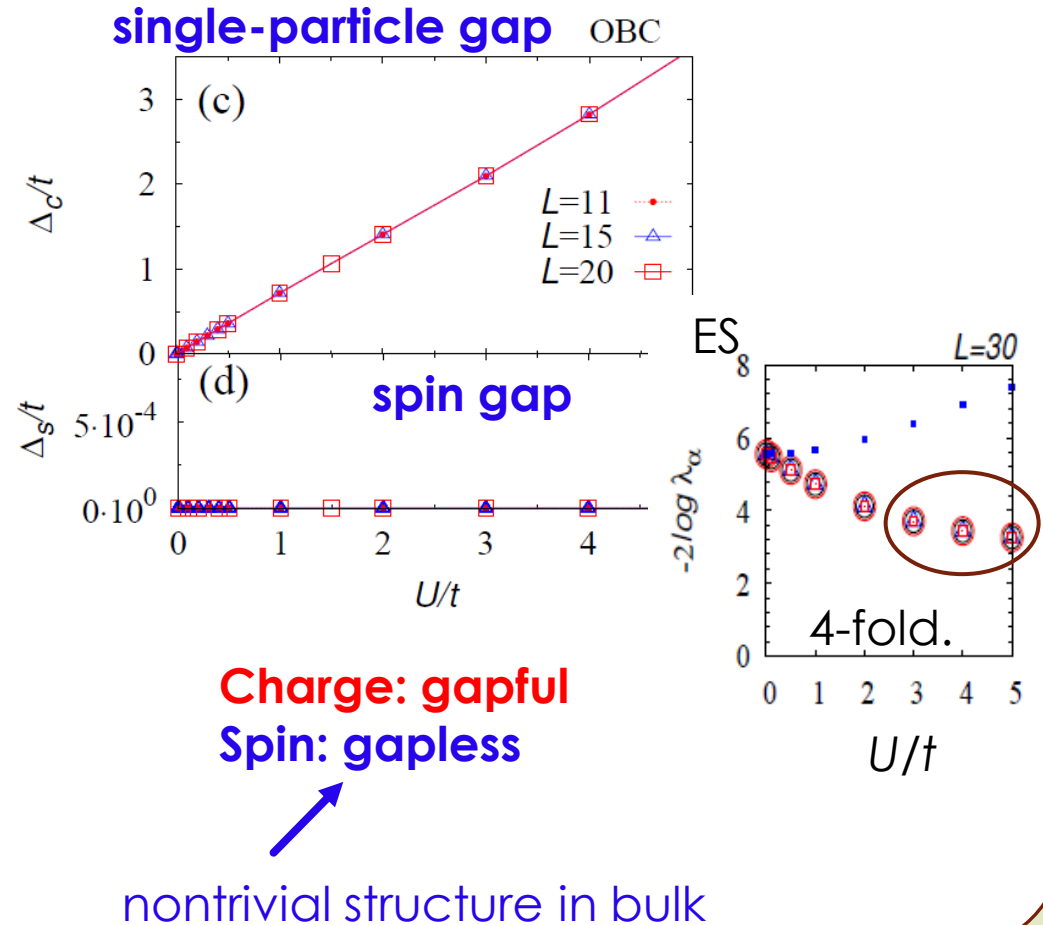
nontrivial structure in bulk

For $V=-0.4/t$, nontrivial at $U=0$.

PBC [bulk]



OBC [edge(+bulk)]



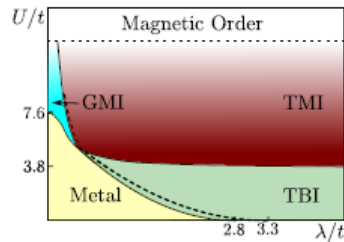
The topological Mott insulator is established in 1D !!

Summary

Correlation effects on gapless edge modes and topological phase transitions.

(SSH+U)

Topological Mott insulator is realized in 1D.

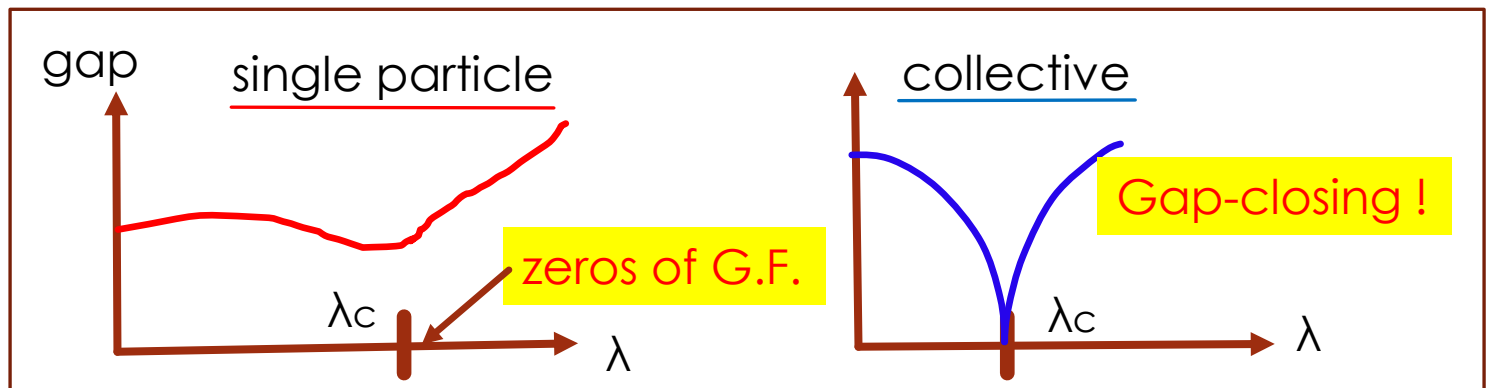


D.A. Pesin *et al.* (2009)

single particle excitation: gapful
spin excitation: gapless (**protected**)

(SSH+UJ)

Interaction induced topological transition (**unconventional !**)



TY, R. Peters, S Fujimoto, and N. Kawakami. PRL 112, 196404 (2014)