



The Higgs Centre Workshop on Topological Quantum Matter

“Higgs Center is also about
coming up with great new questions”

Conference Summary etc....

Steven H. Simon



Duncan Haldane

Topologically protected edge states,
topological order and entanglement

Review of some key ideas starting with
Prehistory of Tamm and Shockley (1930s!)

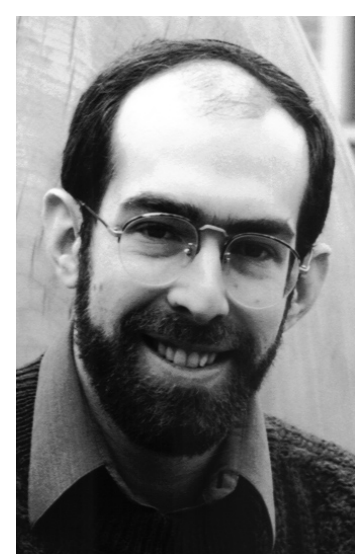
Questions:

Thermal Response as Gravitation

How universal is thermal Hall formula?

Gravitational anomaly and protected edge modes (Ryu)

Relation to modular invariance



David Goldhaber-Gordon

Super-TI Hybrids

Encouraging technical advances in making and measuring hybrid devices.

Questions:

Properties of Proximity Effect in TIs:

Why is $I_c R_n = 1/\text{Width}$

Why is London length (2-3 x) larger in TI hybrids

Are these special to TIs?

Is a clear “fast” measurement of Majorana physics possible

Stefan Kuhr

Strongly Correlated Quantum Systems With Single Atom Resolution (Atom Lattices)

Amazing toolbox for probing many body
Quantum systems (ex, Hubbard model)

Questions:

Someday, will we even remember that we once studied
Hubbard Model in real materials?

Cooling! Can we get to Anti-Ferro Regime
(Much less superconducting!)



Charlie Marcus

Zero Bias Conductance Peaks in Nanowires (did we find Majorana?)

Story is far more complex than originally thought.

Not just “Elusive because the guy disappeared”

Questions:

Can we convincingly distinguish between Majorana
Zero bias peaks and Zero bias peaks from sources?

Why can't we make a good proximity gap?

What would be a “smoking gun” experiment?



Steve Girvin

Circuit QED

Amazing toolbox for precision quantum information processing.

Q close to a billion!

four component cat 



Questions:

Are the rest of us just wasting our time?

What is the limiting factor? (out of Equilib quasiparticles)

Assembling many of these qubits to build ex,
surface codes, or other scalable technologies



Xiao-Gang Wen

Topological Order: Long range entanglement to unification of light and electrons

Questions:

Classification of all phases of matter?

tensor categories, group cohomology

Is the (bosonic) classification of SPTs by group cohomology complete? How can this be extended?

Can the standard model (+beyond) be described
In terms of “space-forming qubits”

Are we living in a noodle soup?





Stephen Barnett

What is Quantum Information

Review Talk on Quantum Information

Questions:

Entanglement as a resource in Quantum Information

Entanglement characterizes phases of matter (cf Wen,
Moore)

What Quantum Algorithms can we construct beyond
those already known

How long until Steve Girvin builds quantum computer?



Joel Moore

Probing edge and surface with transport

Questions:

Someone please do the proposed
“smoking gun” TI-majorana experiments

The power of MPS numerical methods (this is the future)

Is there generally a stephan-boltzmann law for integrable
models – what is the $f()$ function.

“Joel Moore gave an insightful talk and raised a lot of open questions”



Piers Coleman

Heavy Fermion Physics: Rise of Topologies



Questions:

Are Topological Materials almost “Generic” in highly interacting systems.

Can we understand edge states as broken singlets (why are edge modes light, do edges have transitions)

General topological classification with interactions (Wen)

Understanding Kondo Quasicrystals – Should we think in 6D.



Aharon Kapitulnik

Time Reversal Breaking in Superconductors

Measuring Kerr rotation to Nanoradians!

Questions:

Clear time reversal breaking signal in Sr_2RuO_4
Can we resolve other conflicting experiments

Will this resolve debates about UPt_3

What does gyrotropic order in the pseudogap regime mean for “the theory” of high T_c ?



The Higgs Centre Workshop on Topological Quantum Matter

Thank you to everyone for coming!

Particular thanks to all the speakers...

... and also thanks to the (real) organizers:

Andrew Huxley, Julie Massey, Christine Edwards

Please Return your badges on the way out.

