Conference Summary

N. Read

IHP, Paris, Nov 4, 2011

Coming soon to a cinema near you . . .

starring:

Jean-Sebastien Caux as **Tin-Tin**

Andrei Bernevig as **Captain Haddock**

Steve Simon as **Red Rackham**

Phase transitions

Gruzberg

Integer quantum Hall and related transitions

“Conformal restriction” measures --- a useful tool for exact results

Also applies to truncated models (Ikhlef, Fendley, Cardy)

---the Ising model of disordered fermions?

Relation to log CFT?

Slingerland

Picture seems correct

--- “differences” of top. phases at an interface are analogue of K-theory classes in non-interacting fermion systems, deserve more study

One dimension

Ardonne, Caux, Fendley

Exact --- and very detailed (J-S) --- solutions

To what extent does calculating one-point functions “solve” the model?

Why are CFT characters showing up as these 1-pt functions?

Solution of Fendley’s model?
When will we see the soluble 2+1 lattice model (not using Chern bands) for k>2 parafermion phases?

Effective field theory

Hansson

Interesting BF type theory

More microscopic derivation might clarify e.g. $e^{i\pi/8}$ in exchange

More generally, spin of quasiparticles usually not apparent in “topological” effective theories (no dependence on metric, or connection)

---should couple to curvature of space

---does not involve a microscopic length

(Top. theories fine for top. invariants of links, 3-manifolds)

Topology

Costantino, Funar

Role of asymptotics: as $q^n \to 1$ (some fixed n), or as

$$k \to \infty \qquad (q = e^{i\pi/(k+2)} \to 1),$$

some information is obtained from expansion near, not at, limit

Loose analogy with some CFTs (loop models), some interesting quantities are obtained by expanding near the limit (a root of unity). (Cardy)

Constructing and counting trial wavefunctions

Estienne

Constructions of $U(1) \times M(3, p)$ and other wavefunctions using Calogero-Sutherland and Jack polynomials/functions

---very elegant

---for RR states, those “Jack” polys were known (Kedem, Ardonne, Stone; Read)

---what is the meaning of the wavefunctions from non-unitary CFTs?

Norms/screening in trial wavefunctions

Bonderson

Plasma mapping with additional charges, screening phase now confirmed numerically

If screening/massive, then non-Abelian stats = analytic continuation

Other states?

Entanglement, what is?

Bernevig, Dubail

http://www.yodaspeak.co.uk/

(and entropy)

Entanglement spectrum in different situations

Maybe the most natural way to think about a topological phase – long-range entanglement mediates the gauge field effects

How to define bipartition in QH systems?

--- really want it to be **local,** as real-space partition is

--- then for RSP (also PP), upshot of Dubail's argument is that

$$\rho_A \sim e^{\int d\theta (\text{local op})} \sim e^{aL_0/R}$$

by locality along the cut

--- linear spectrum in limit

---this is **not clear** for orbital partition at present (degeneracies say not)

Study of entropy of wavefunctions (using CFT)

Misguich

Topological Chern Insulators

Regnault

Misnomer: Nonzero Chern number = non-zero Hall conductivity, not insulator!

Really: quantum Hall states in zero magnetic field

---they exist!

Demonstration using entanglement spectrum (multiplicities)

Spin and Skyrmions in MR state

Schoutens

Interpolation from MR to NASS – continuous w. gapless phase, or phase separation?

Experiment

Simon

Orthodox
Reform
“Unitarian” theories

Evidence of fractional statistics at 7/3?
Evidence of Majorana modes at 5/2???

These may be the most important questions of everything we heard

. . . we await news from W. Kang

Outstanding questions

What is the meaning of non-unitary trial wavefunctions?

---wavefunction presumably not screening except in charge sector

---“special” Ham presumably gapless when it exists

---maybe corresponds to a bulk critical point as for Haldane-Rezayi?

---how does entanglement spectrum behave (not only multiplicities)?

Are all wfns from unitary CFTs in a massive (screening) phase?
(Or only a fortunate few (Bonderson)?)

Gapped QH states with a non-zero density of non-Abelian quasiparticles at fixed positions

---what phase?

---for MR with randomly placed qholes, Ludwig and I argued the ground state is the strong-pairing phase – is this becoming relevant to experiments?

Conformal block trial wavefunctions (Moore, NR, 1991)

---can view as generalization of Matrix Product States (Cirac, Sierra)

---use in 1D, spin chains etc

---**Natural and somewhat central role**

Conclusion

Many fascinating talks

Plenty of open questions