Methods for attacking strong interacting problem:

1. anstze of wave-function and exactly solvable models
2. effective field theory
   (guess the relevant D.O.F)
3. Duality
4. Tensor network, numerical ....
5. ...

Strong-interacting system is essentially different from weak systems where intuition and concepts may fail.

Quantum gravity (geometry)

quantum: discrete, algebraic (∞-dim)
geometry

Emergent ⇝ continuous geometry (low energy & illusion)

→ new language "quantum calculus" (providing geometric intuition)

many-body problem nature.

Foundation of qm:

Entanglement suggest non-locality

holography is allowed only in non-local geometry.

Infinite-D.O.F (such as field theory) is indespensible.
(many-body!) (not well grounded, ill-defined)

what is then "quantum" (quantization)?

claim: algebraic, discrete, categorical

Claim: Finding new, systematic methods (even new calculus) for the study of quantum many-body system.

infinite-many (emergency).

There're many ∞-dim mathematical structure emergent only in the infinite size limit: (thermodynamic limit)

(not really a limit of finite entities)

The modern lesson from mathematics is:

infinitely more is fundamentally different from finitely more

Physics: holography (non-local).

boundary-bulk duality.

infinity is strange and full of possibility

too hard to understand, too easy to be ignored

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defect → "elements" in category

UMT or UT 2-category ΣM

1-category

M

$\Rightarrow$ $A = (M, c)$ or $(\Sigma M, c)$

A: top. order

c: chiral central charge.

(anomaly free)

invertible top. but not trivial (E& state)

study of gapped $\longrightarrow$ gapless