Entanglement in quantum physics

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Entanglement is a non-local correlation.
Why entanglement is important?
Entanglement can classify phases.

Symmetry breaking

Entanglement (Non-local order)

Ferromagnet

Quantum liquid (No symmetry breaking at zero temperature)

Antiferromagnet
Entanglement can be measured experimentally.

ultracold bosonic atoms in optical lattices

[Islam, Rajibul, et al. Nature 528.7580 (2015): 77-83. Figure 4a]
Entanglement can be described by holography.

Ryu-Takayanagi formula

\[ S_A = \frac{\text{Area}(\tilde{A})}{4G_N} \]

[S. Ryu, T. Takayanagi, 2006]
Summary

- Entanglement is an important non-local order.

- Entanglement is a useful concept in various fields.