Entanglement

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Quantum entanglement

Orientation entanglement

Entanglement (graph measure)

Entanglement of polymer chains, see Reptation

Wire entanglement

in fishery: method by which fish are caught in fishing nets

unintended entanglement of marine fish and mammals in ghost nets or similar: Plastic pollution#Entanglement

Quantum entanglement

Quantum entanglement is the phenomenon where the quantum state of each particle in a group cannot be described independently of the state of the others - Quantum entanglement is the phenomenon where the quantum state of each particle in a group cannot be described independently of the state of the others, even when the particles are separated by a large distance. The topic of quantum entanglement is at the heart of the disparity between classical physics and quantum physics: entanglement is a primary feature of quantum mechanics not present in classical mechanics.

Measurements of physical properties such as position, momentum, spin, and polarization performed on entangled particles can, in some cases, be found to be perfectly correlated. For example, if a pair of entangled particles is generated such that their total spin is known to be zero, and one particle is found to have clockwise spin on a first axis, then the spin of the other particle, measured on the same axis, is found to be anticlockwise. However, this behavior gives rise to seemingly paradoxical effects: any measurement of a particle's properties results in an apparent and irreversible wave function collapse of that particle and changes the original quantum state. With entangled particles, such measurements affect the entangled system as a whole.

Such phenomena were the subject of a 1935 paper by Albert Einstein, Boris Podolsky, and Nathan Rosen, and several papers by Erwin Schrödinger shortly thereafter, describing what came to be known as the EPR paradox. Einstein and others considered such behavior impossible, as it violated the local realism view of causality and argued that the accepted formulation of quantum mechanics must therefore be incomplete.

Later, however, the counterintuitive predictions of quantum mechanics were verified in tests where polarization or spin of entangled particles were measured at separate locations, statistically violating Bell's inequality. This established that the correlations produced from quantum entanglement cannot be explained in terms of local hidden variables, i.e., properties contained within the individual particles themselves.

However, despite the fact that entanglement can produce statistical correlations between events in widely separated places, it cannot be used for faster-than-light communication.

Quantum entanglement has been demonstrated experimentally with photons, electrons, top quarks, molecules and even small diamonds. The use of quantum entanglement in communication and computation is an active area of research and development.

Entropy of entanglement

The entropy of entanglement (or entanglement entropy) is a measure of the degree of quantum entanglement between two subsystems constituting a two-part - The entropy of entanglement (or entanglement entropy) is a measure of the degree of quantum entanglement between two subsystems constituting a two-part composite quantum system. Given a pure bipartite quantum state of the composite system, it is possible to obtain a reduced density matrix describing knowledge of the state of a subsystem. The entropy of entanglement is the Von Neumann entropy of the reduced density matrix for any of the subsystems. If it is non-zero, it indicates the two subsystems are entangled.

Mathematically, if a state describing two subsystems A and B

|

?

A

B

?

=

|

?

A

?

?

|

?

B

?

{\displaystyle |\Psi _{AB}\rangle =|\phi _{A}\rangle \otimes |\phi _{B}\rangle }

is a separable state, then the reduced density matrix

?

A

=

Tr

B

?

|

?

A

B

?

?

?

A

B

|

=

|

?

A

?

?

?

A

|

$${\displaystyle \rho _{A}=\operatorname {Tr} _{B}|\Psi _{AB}\rangle \langle \Psi _{AB}|=|\phi _{A}\rangle \langle \phi _{A}|}$$

is a pure state. Thus, the entropy of the state is zero; similarly, the density matrix of B would also have zero entropy. If the entropy of the reduced density matrix is nonzero, the reduced density matrix is a mixed state, which indicates that the subsystems A and B are entangled.

Entanglement entropy was first proposed by Sorkin as a source for black hole entropy, and remains a candidate. It is thought to have connections to gravity, and the possibility of induced gravity, following the work of Jacobson, and ideas of Sakharov.

Flavors of Entanglement

Flavors of Entanglement is the seventh studio album, fifth international release and last Maverick Records release by Canadian singer-songwriter Alanis - Flavors of Entanglement is the seventh studio album, fifth international release and last Maverick Records release by Canadian singer-songwriter Alanis Morissette. The album, which was originally set for an April release, came out on May 30, 2008, in Germany, Benelux, and Ireland, internationally on June 2, and in the United States on June 10. It was produced by Guy Sigsworth. Flavors won Pop Album of the Year prize at the 2009 Juno Awards. The album gets its name from a lyric in the track "Moratorium".

Flavors of Entanglement received generally positive reviews from music critics, praising the new musical style of Morissette's album; however, critics felt the album's lyrics are not as original as Morissette's earlier albums. Charting success of the album was also moderate worldwide. The album peaked at number eight on the US Billboard 200. The album also spawned an American tour called Flavors of Entanglement Tour, which spanned September to November 2008.

Morissette left Maverick Records in 2009, following completion of all promotional activities in support of the album.

Entanglement of formation

The entanglement of formation is a quantity that measures the entanglement of a bipartite quantum state. For a pure bipartite quantum state | ? ? A B {\displaystyle - The entanglement of formation is a quantity that measures the entanglement of a bipartite quantum state.

Entanglement depth

In quantum physics, entanglement depth characterizes the strength of multiparticle entanglement. An entanglement depth k {\displaystyle k} means that the - In quantum physics, entanglement depth characterizes the strength of multiparticle entanglement. An entanglement depth

k

{\displaystyle k}

means that the quantum state of a particle ensemble cannot be described under the assumption that particles interacted with each other only in groups having fewer than

k

{\displaystyle k}

particles. It has been used to characterize the quantum states created in experiments with cold gases.

Entanglement swapping

In quantum mechanics, entanglement swapping is a protocol to transfer quantum entanglement from one pair of particles to another, even if the second pair - In quantum mechanics, entanglement swapping is a protocol to transfer quantum entanglement from one pair of particles to another, even if the second pair of particles have never interacted. This process may have application in quantum communication networks and quantum computing.

Entanglement (film)

Entanglement is a 2017 Canadian romantic comedy-drama film directed by Jason James and written by Jason Filiatrault. It stars Thomas Middleditch, Jess - Entanglement is a 2017 Canadian romantic comedy-drama film directed by Jason James and written by Jason Filiatrault. It stars Thomas Middleditch, Jess Weixler, Diana Bang, and Randal Edwards, and follows Ben (Middleditch) who forms a romance with Hanna (Weixler) after discovering through various means that they could have almost ended up siblings. This is the first feature film produced through Dark Star Pictures and premiered at the Seattle International Film Festival on March 19, 2017, before being theatrically released on February 2, 2018.

Entanglement monotone

entanglement monotone or entanglement measure is a function that quantifies the amount of entanglement present in a quantum state. Any entanglement monotone - In quantum information and quantum computation, an entanglement monotone or entanglement measure is a function that quantifies the amount of entanglement present in a quantum state. Any entanglement monotone is a nonnegative function whose value does not increase under local operations and classical communication.

Entanglement distillation

Entanglement distillation (also called entanglement purification) is the transformation of N copies of an arbitrary entangled state ? {\displaystyle \rho - Entanglement distillation (also called entanglement purification) is the transformation of N copies of an arbitrary entangled state

?

{\displaystyle \rho }

into some number of approximately pure Bell pairs, using only local operations and classical communication. Entanglement distillation can overcome the degenerative influence of noisy quantum channels by transforming previously shared, less-entangled pairs into a smaller number of maximally-entangled pairs.

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