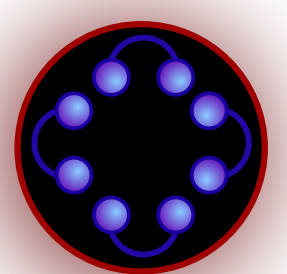
Black holes and quantum computers

David Wakeham



University of British Columbia

February 3, 2021

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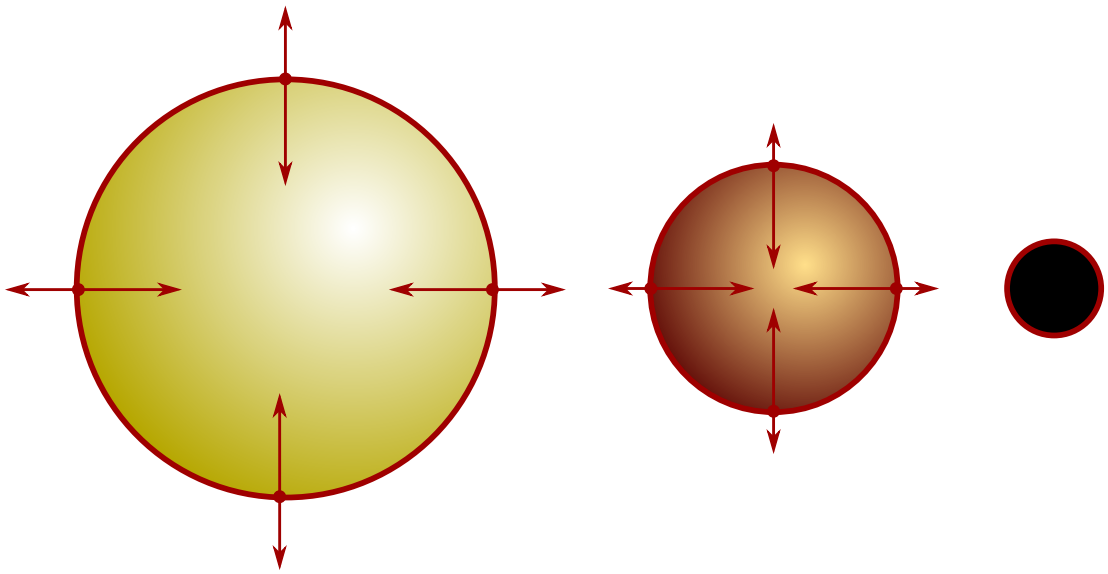

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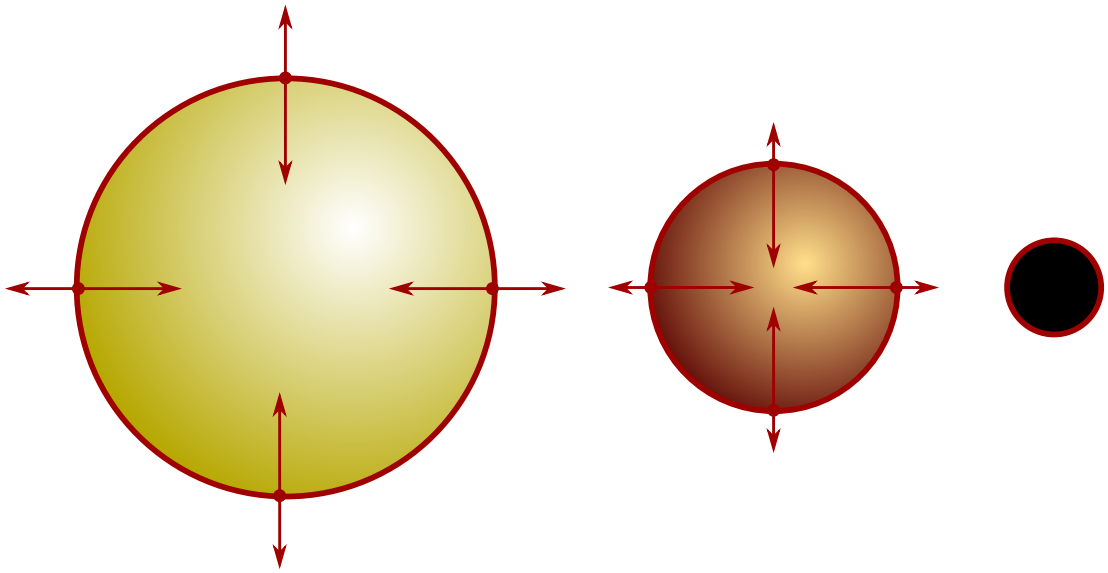

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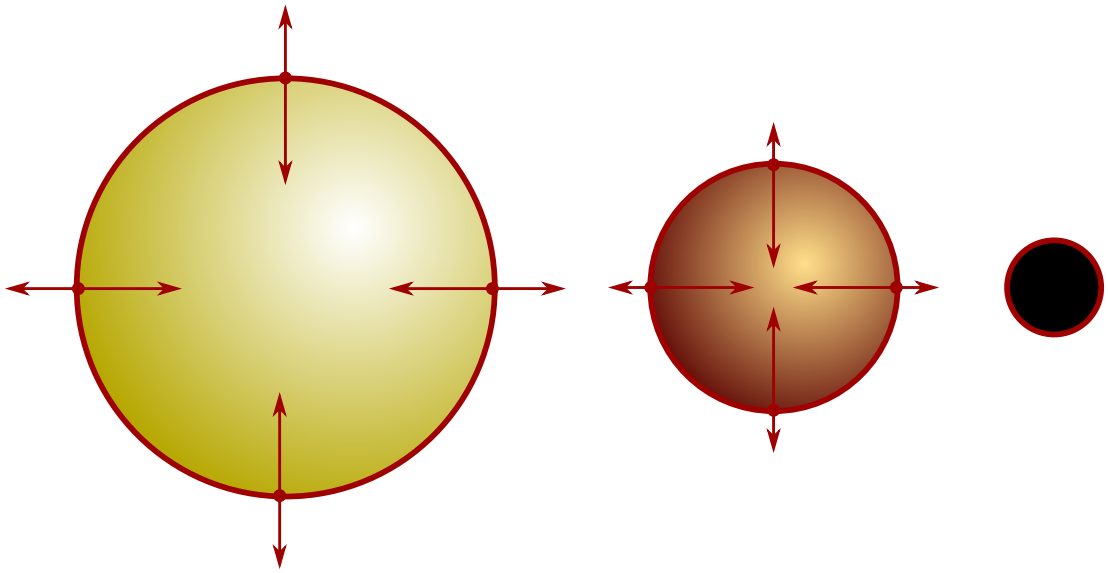

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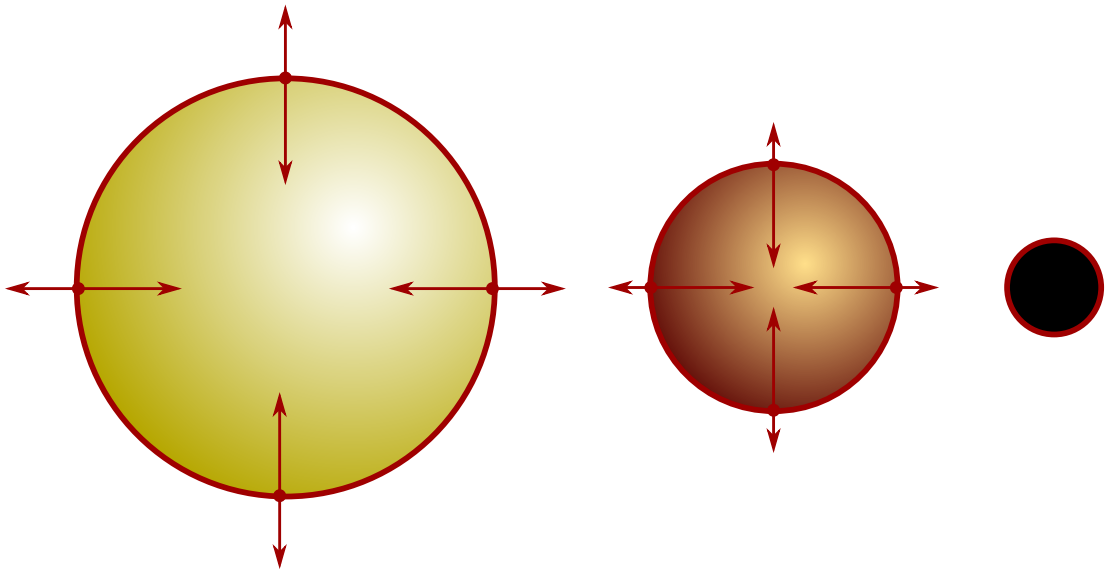

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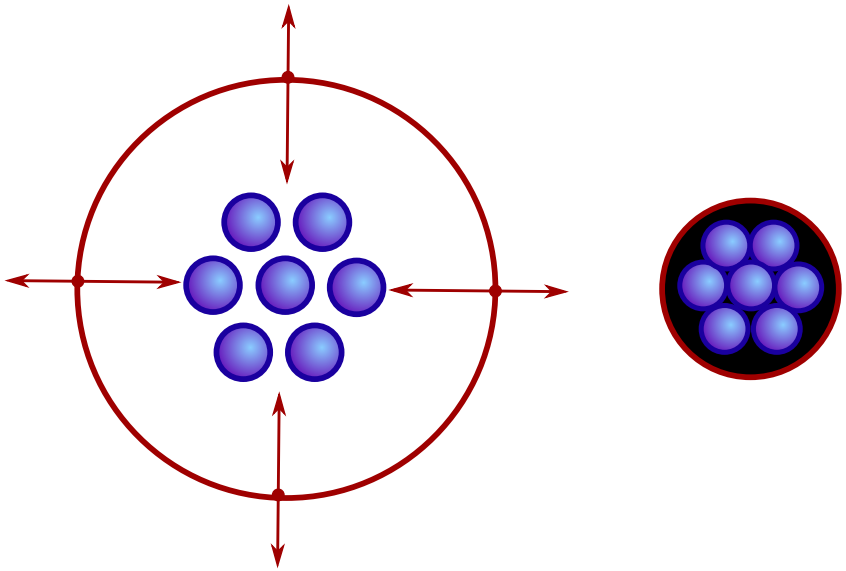

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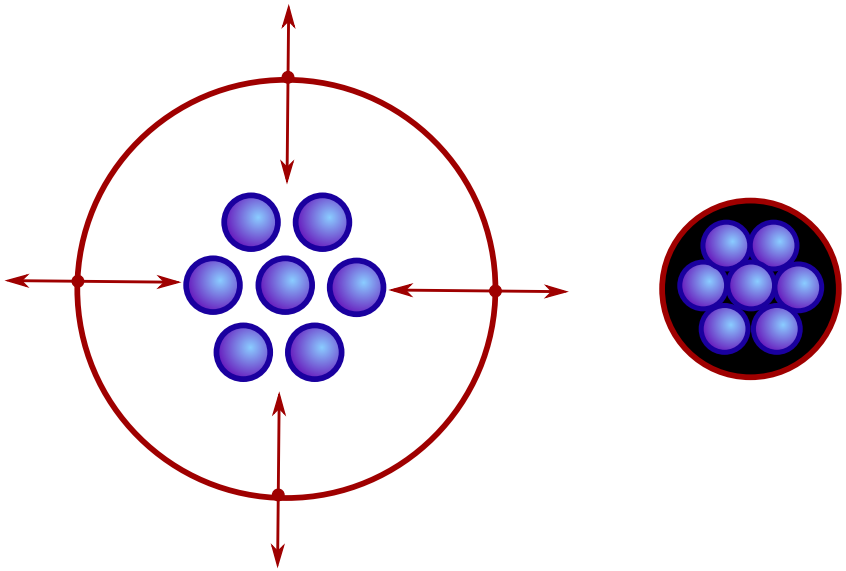

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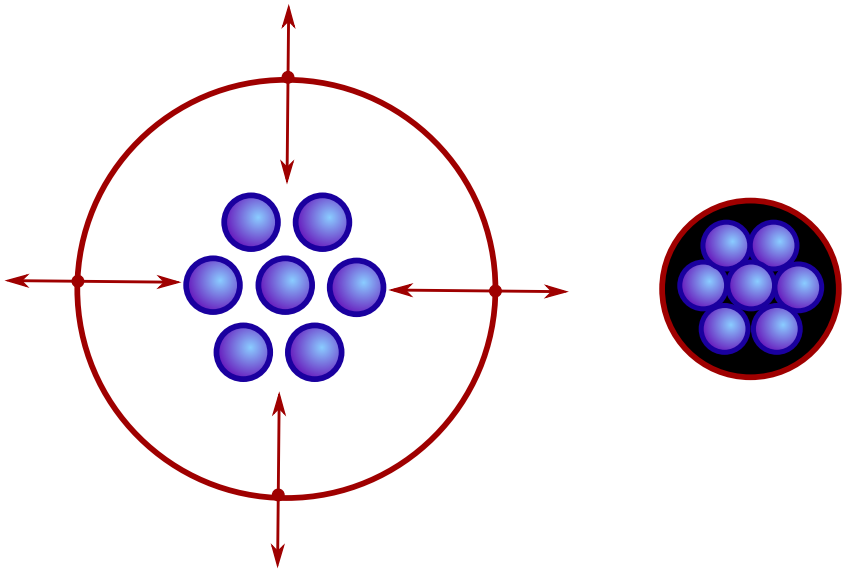

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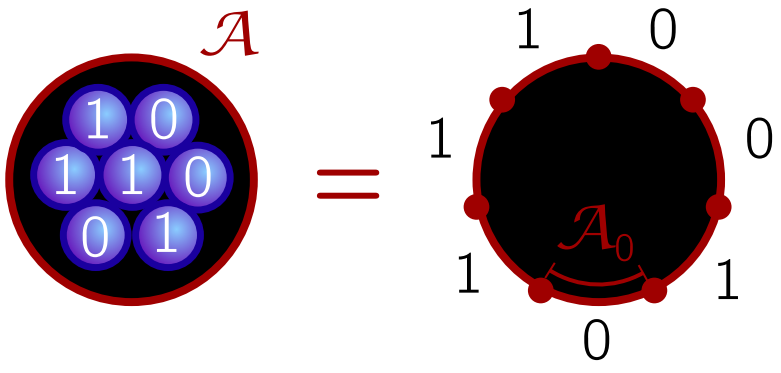

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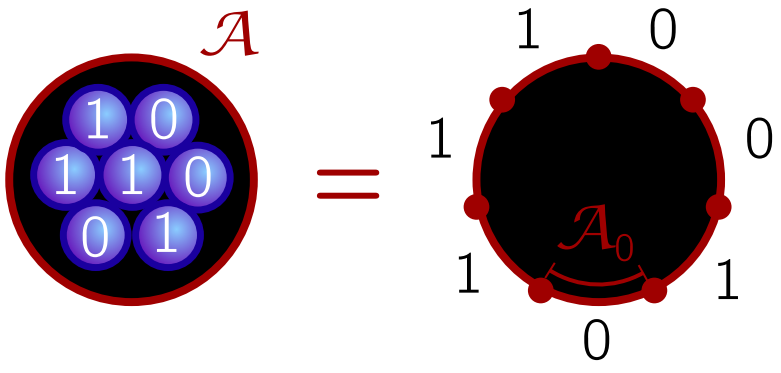

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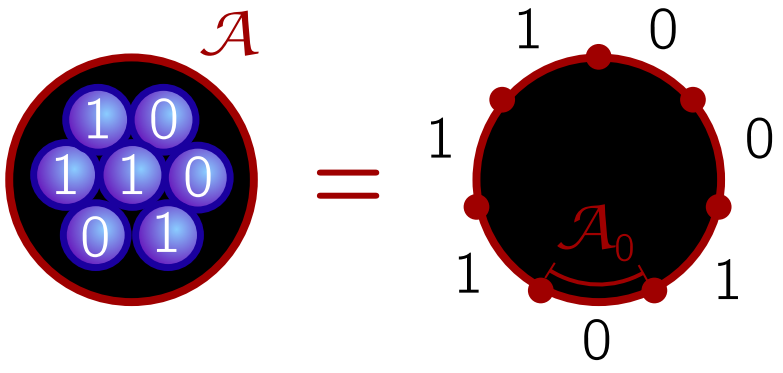

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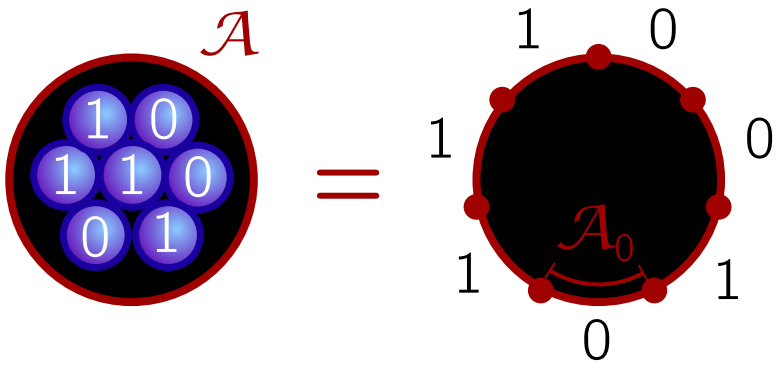

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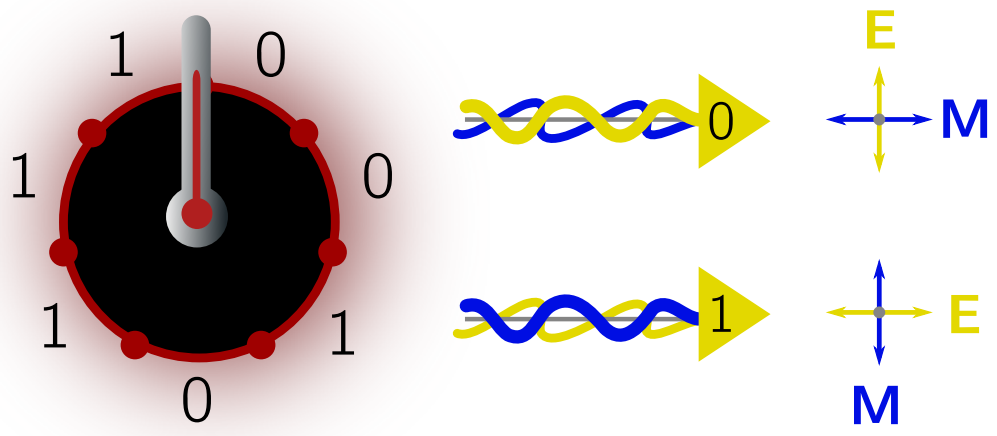

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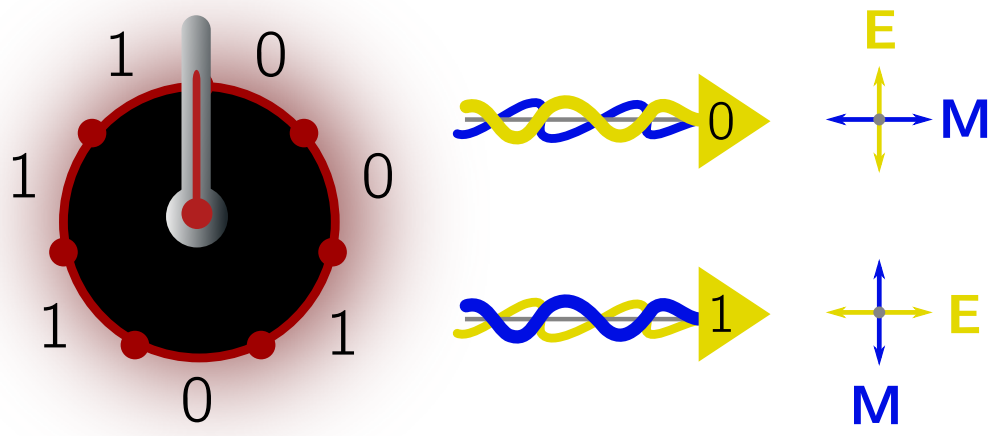

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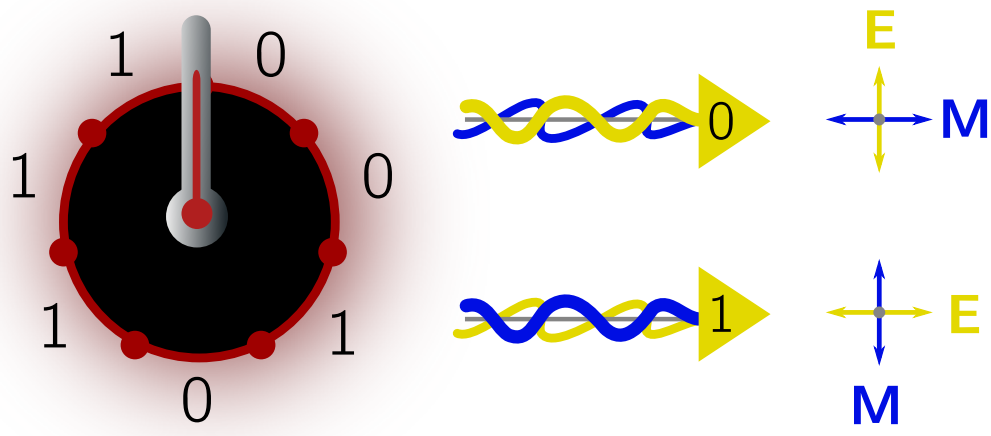

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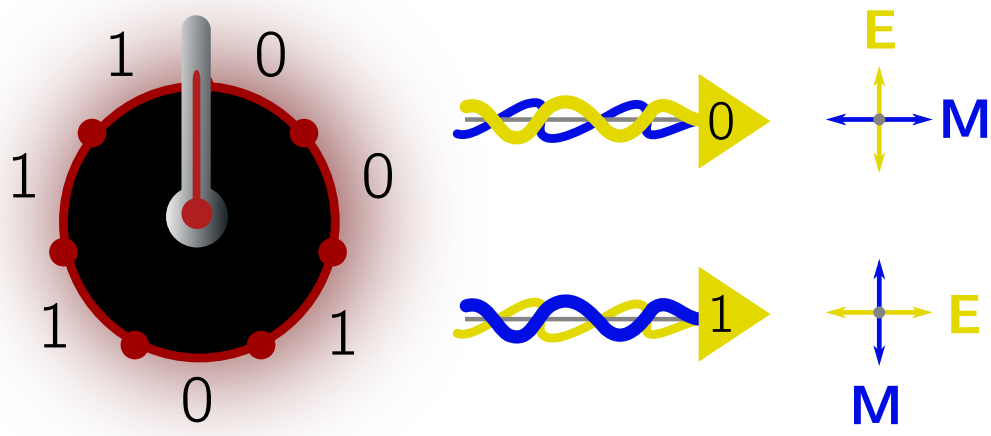

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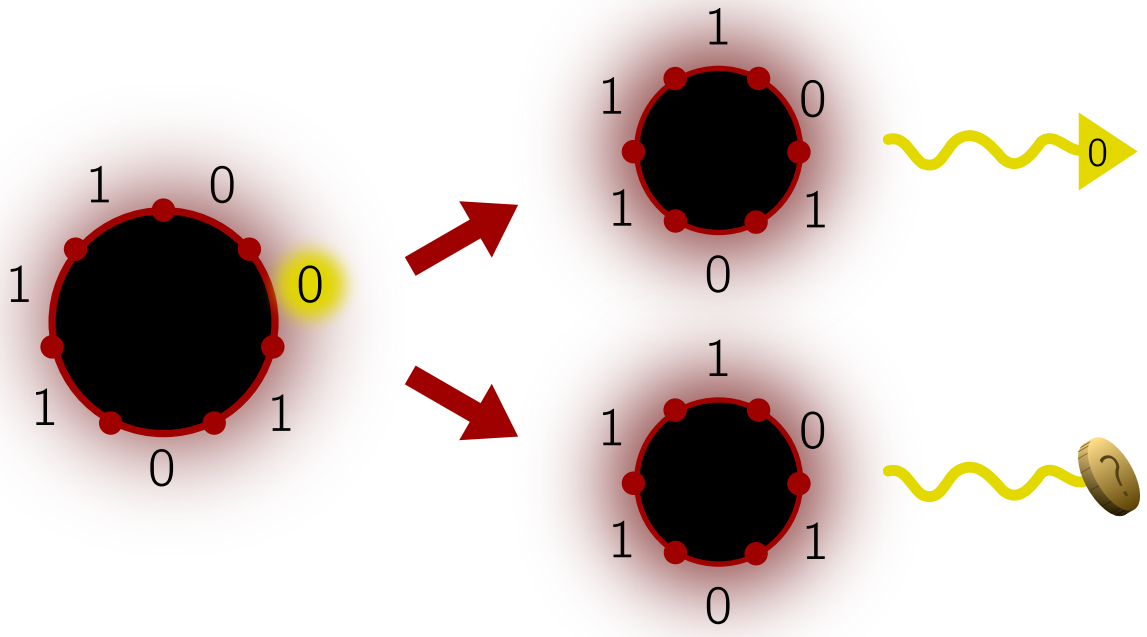

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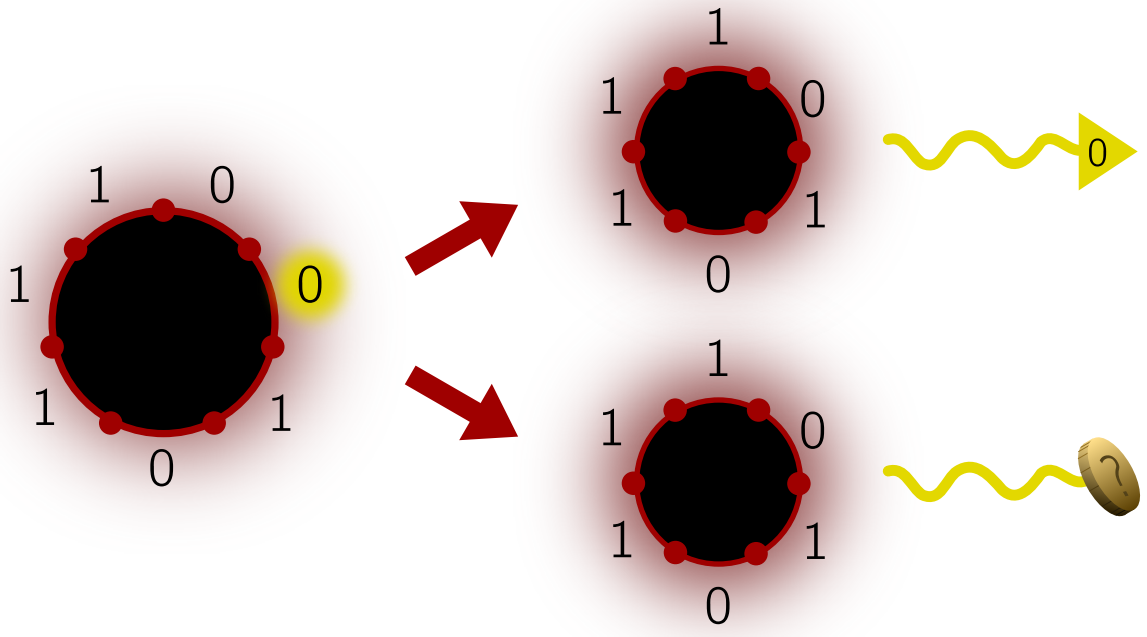

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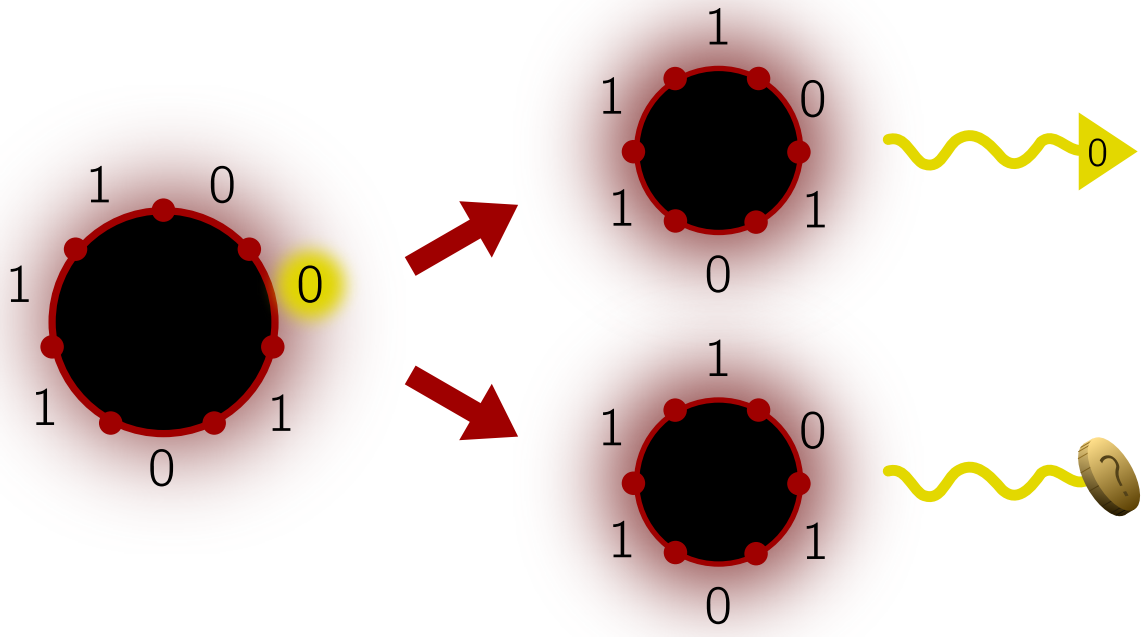

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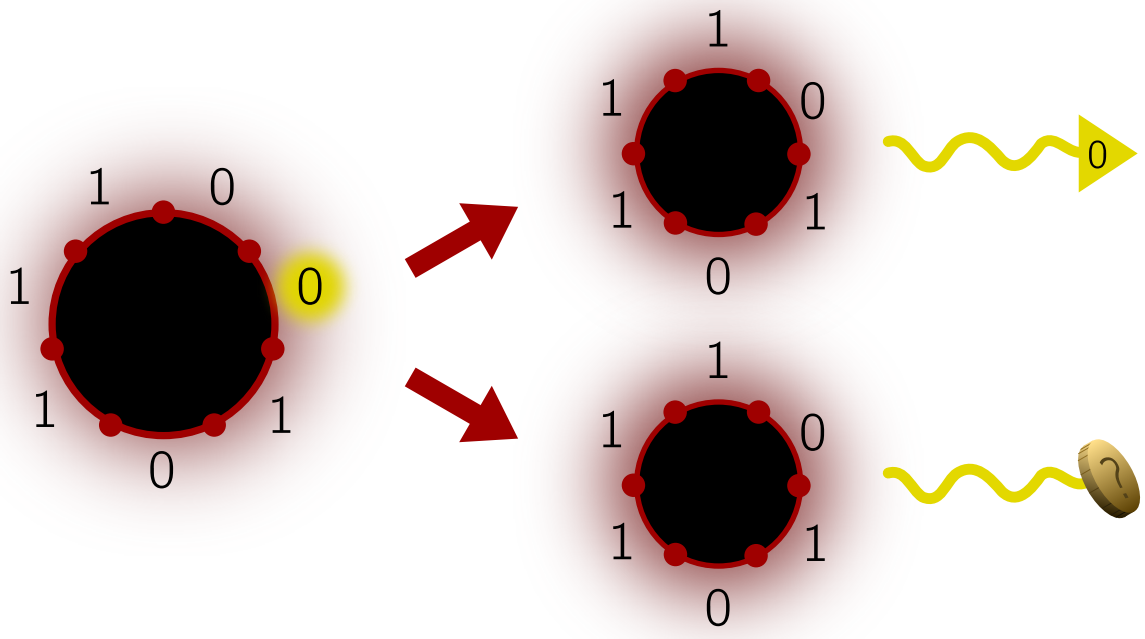

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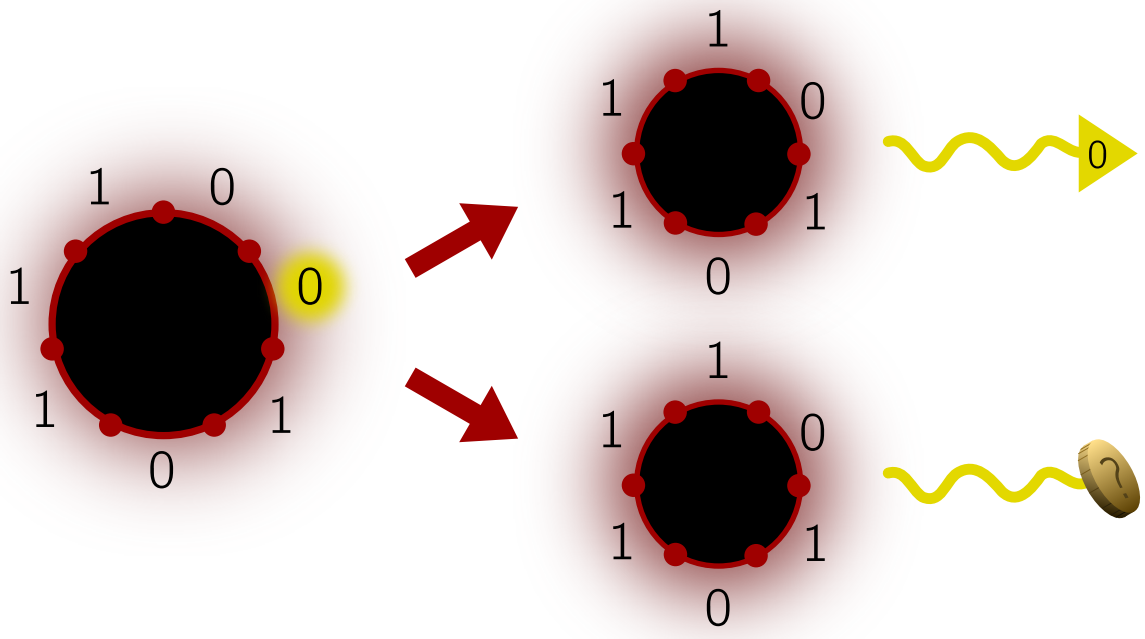

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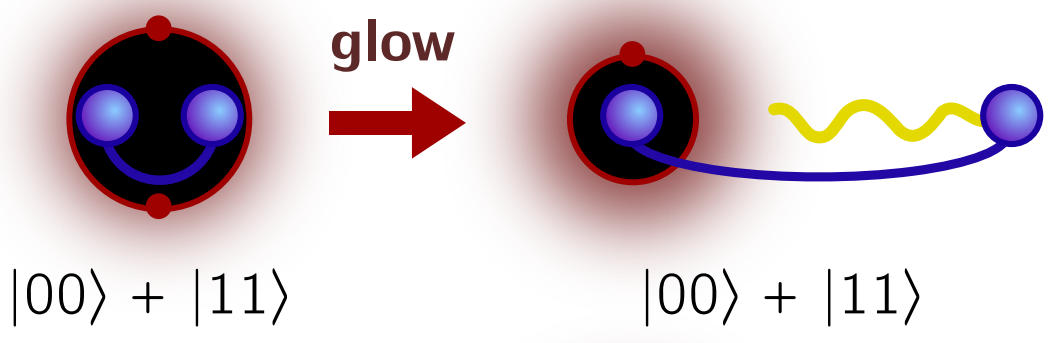

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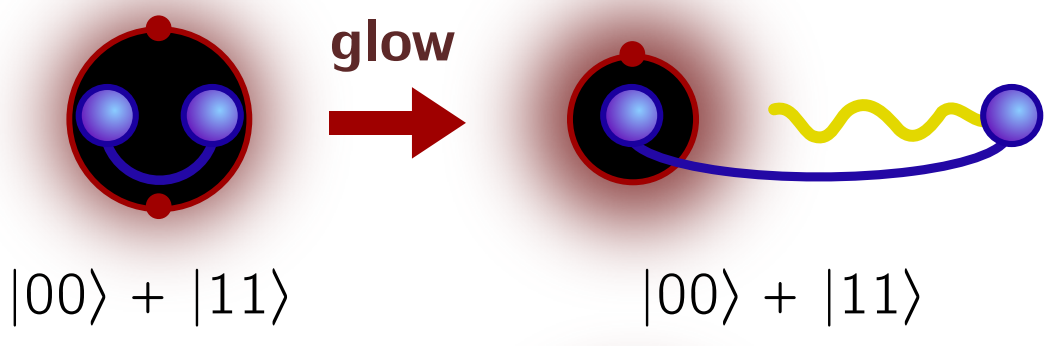

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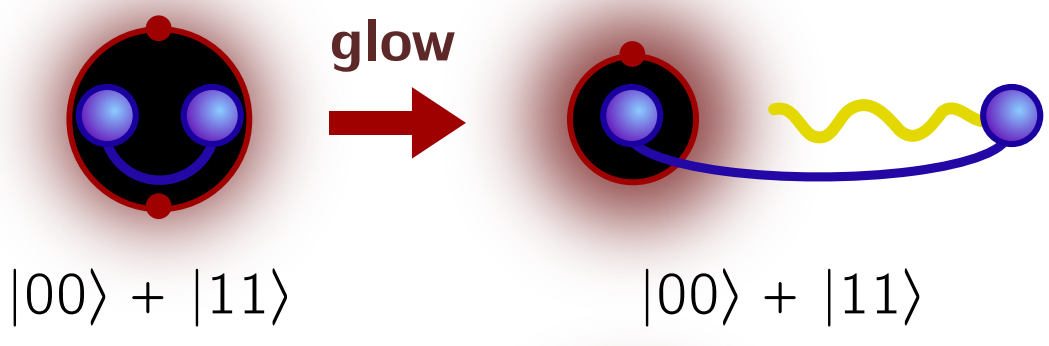

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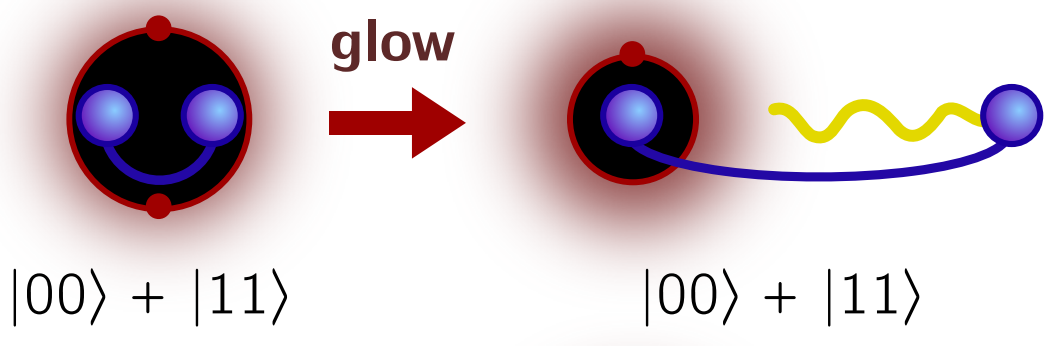

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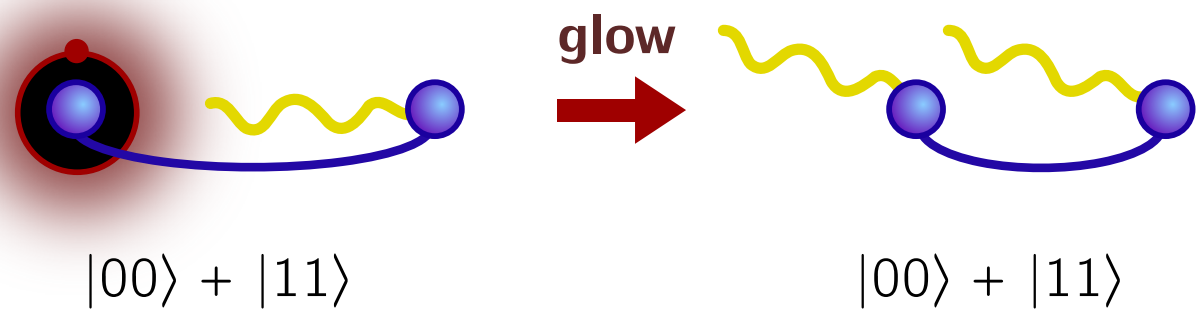

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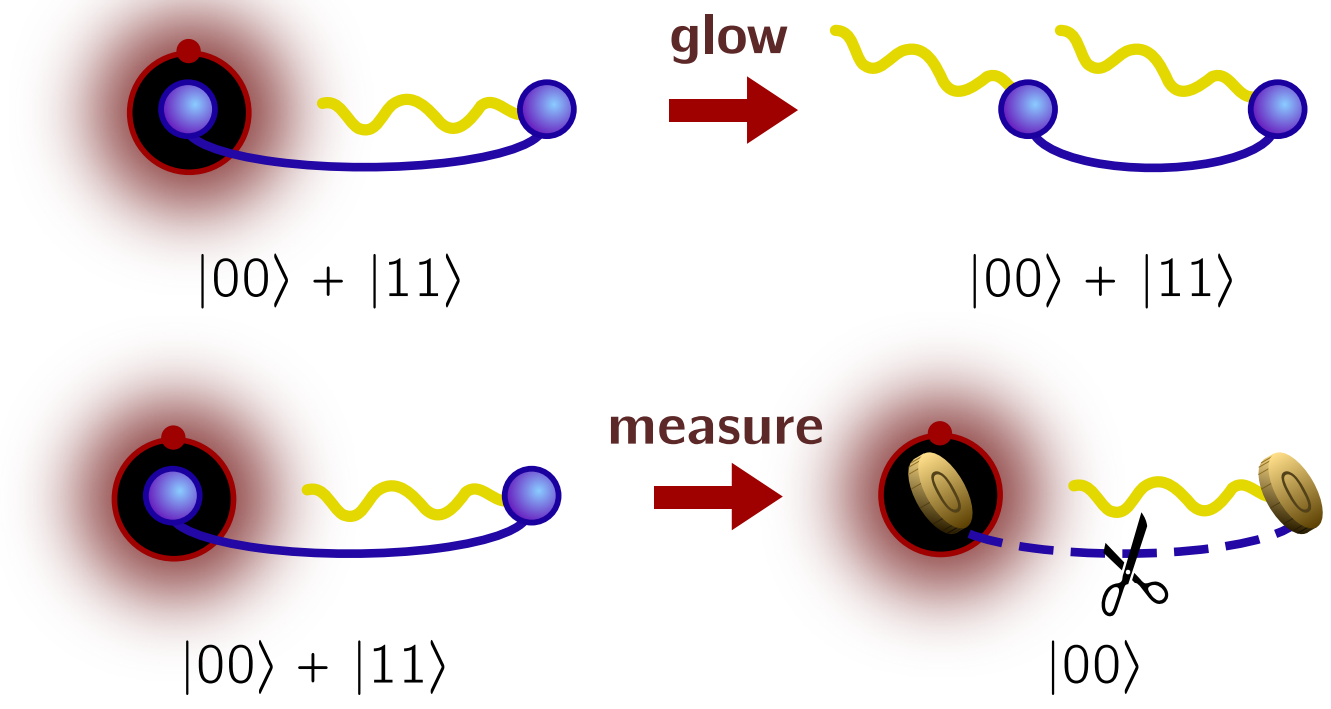

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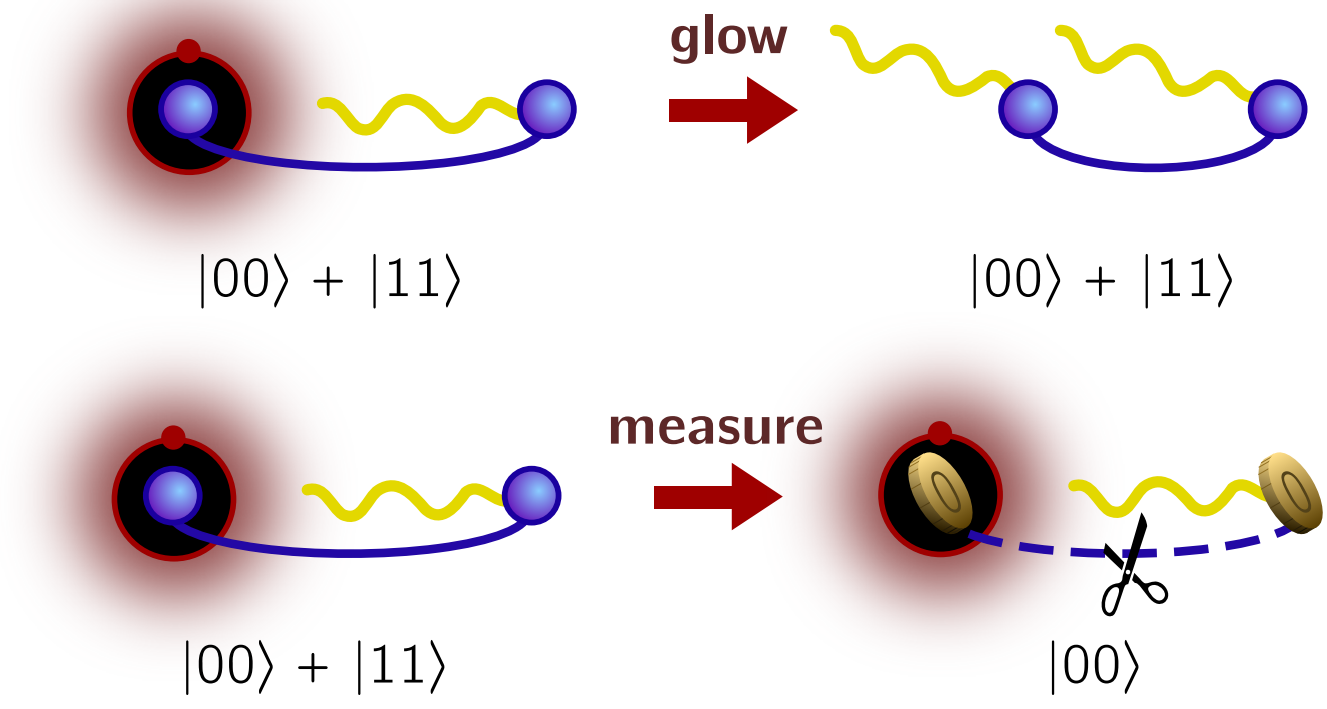

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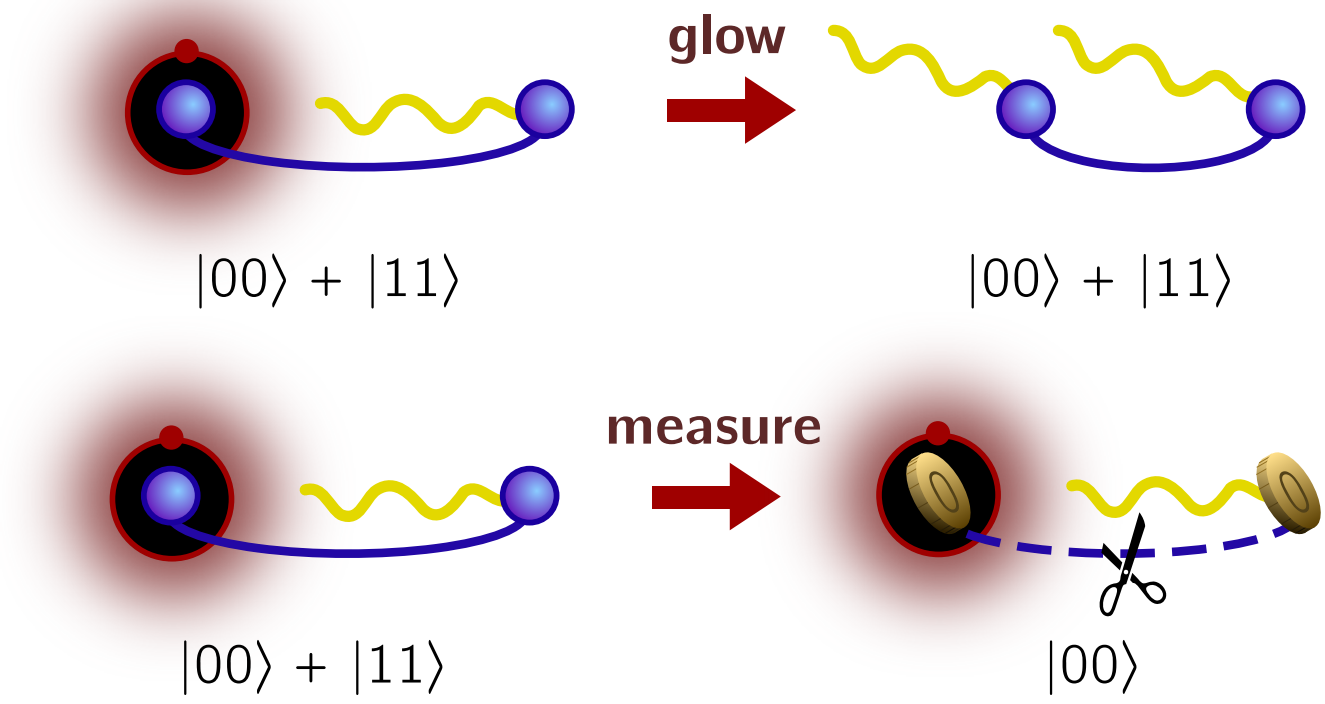

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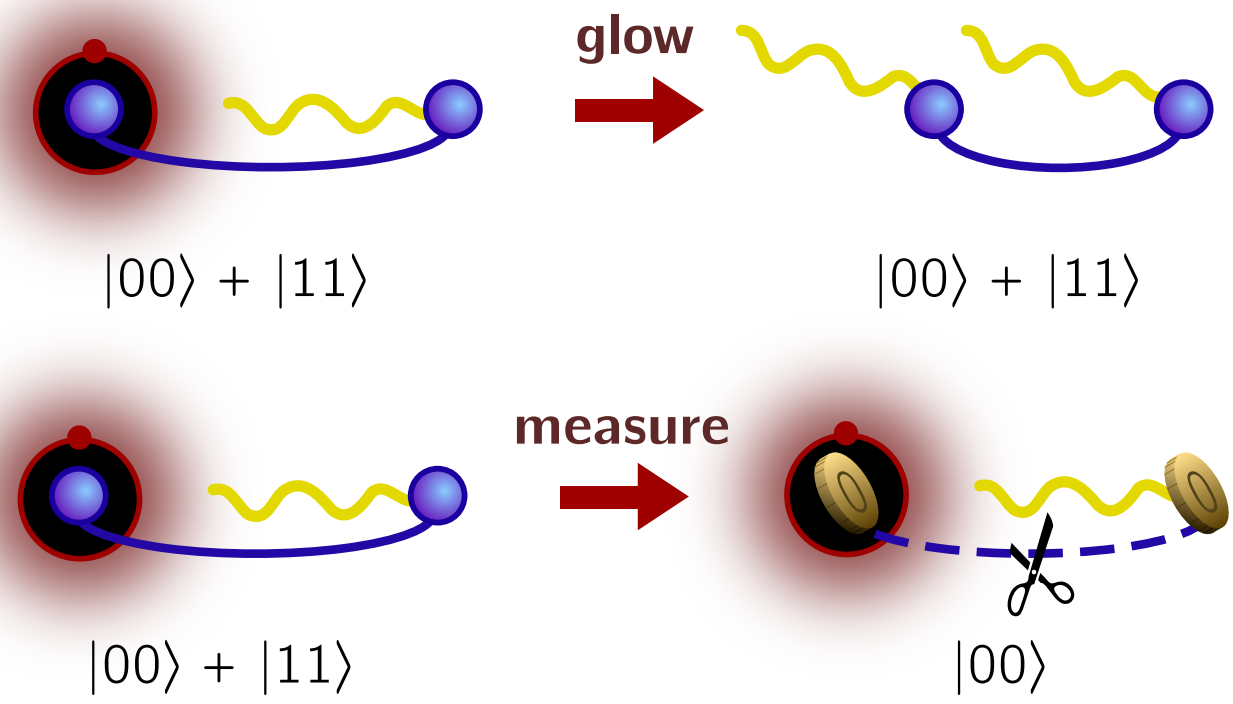

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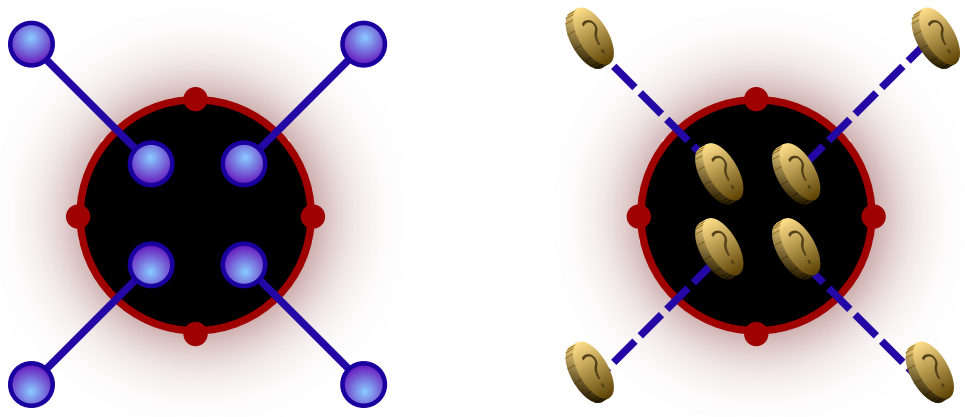

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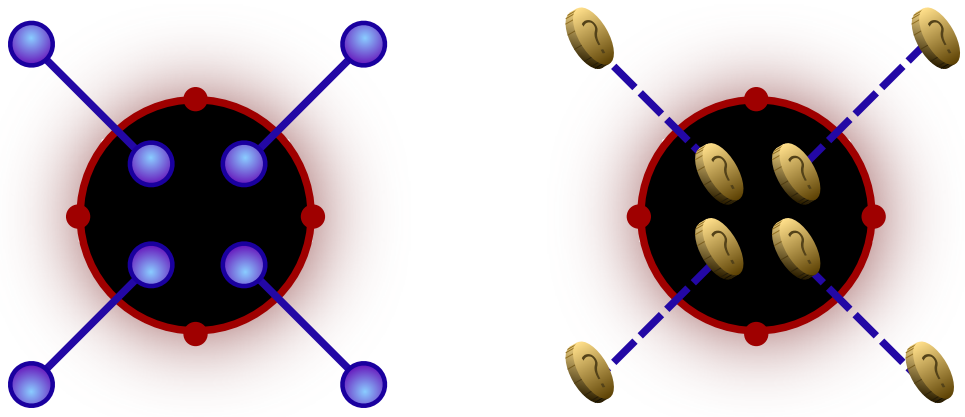

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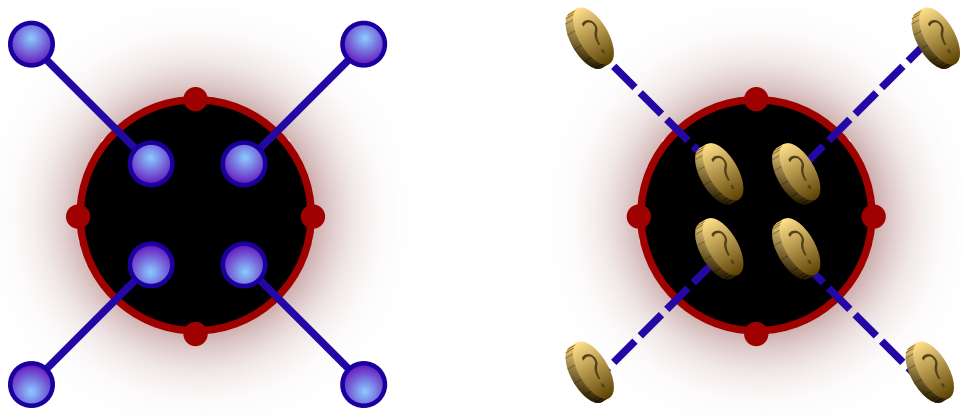

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- They don't need to pair up, but they can if they want.

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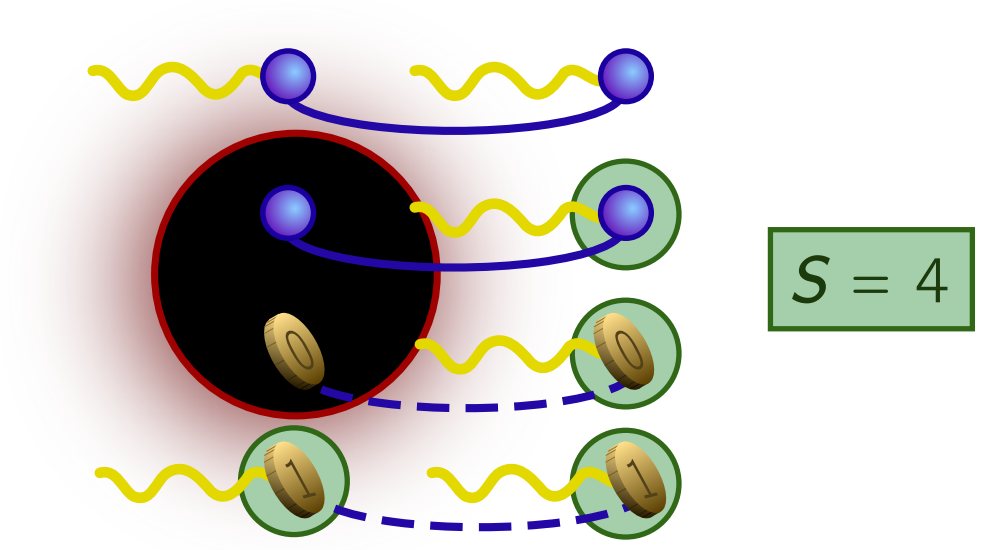

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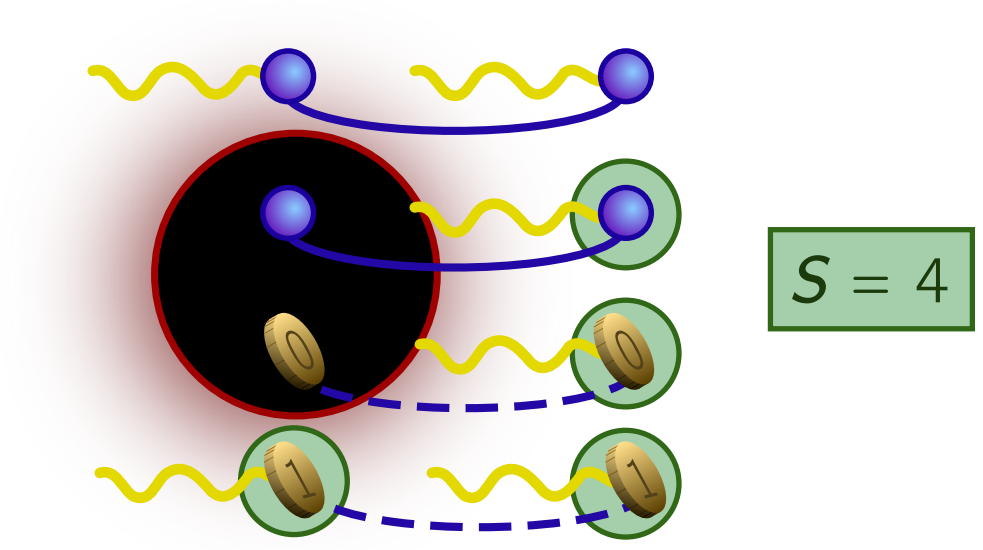

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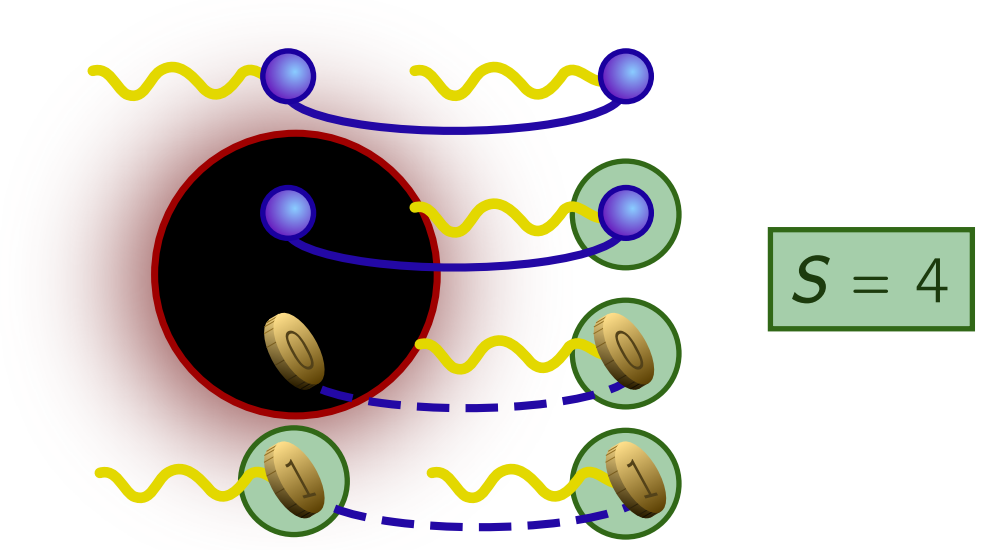

- Note that if you measure only one end of an entangled pair, you effectively turn it into a coin.

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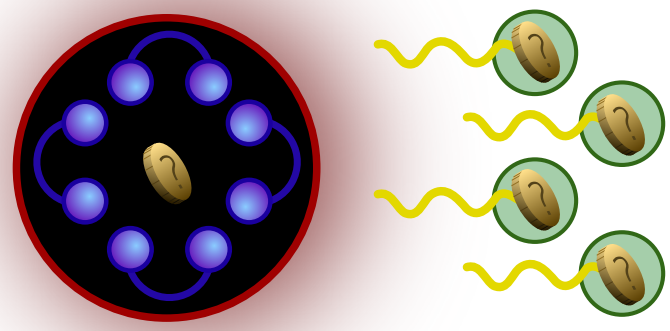

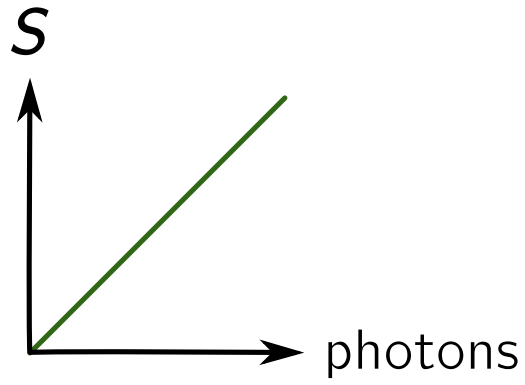

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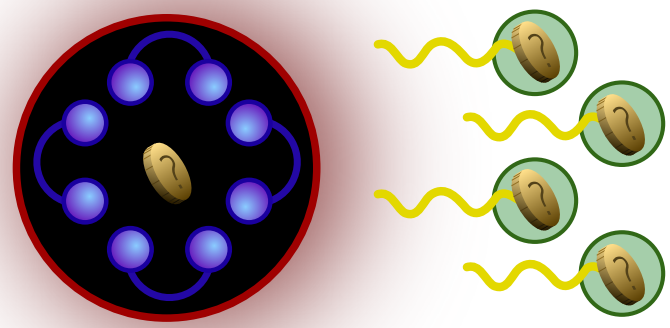

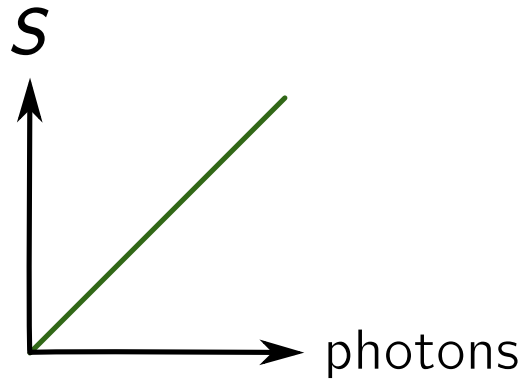

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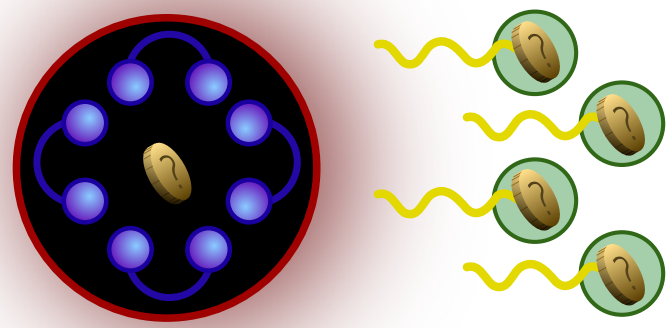

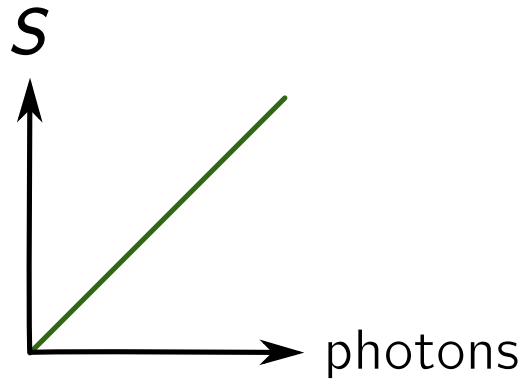

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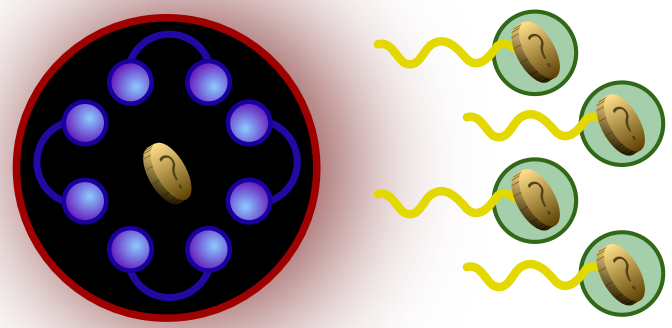

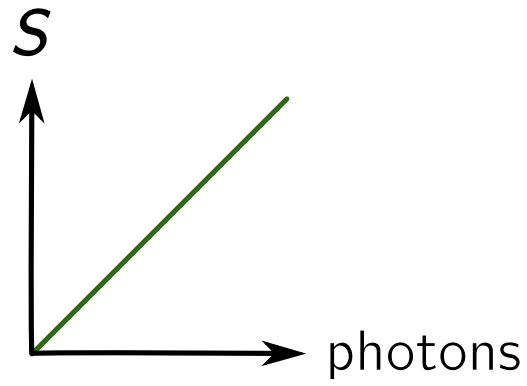

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Evaporating pairs

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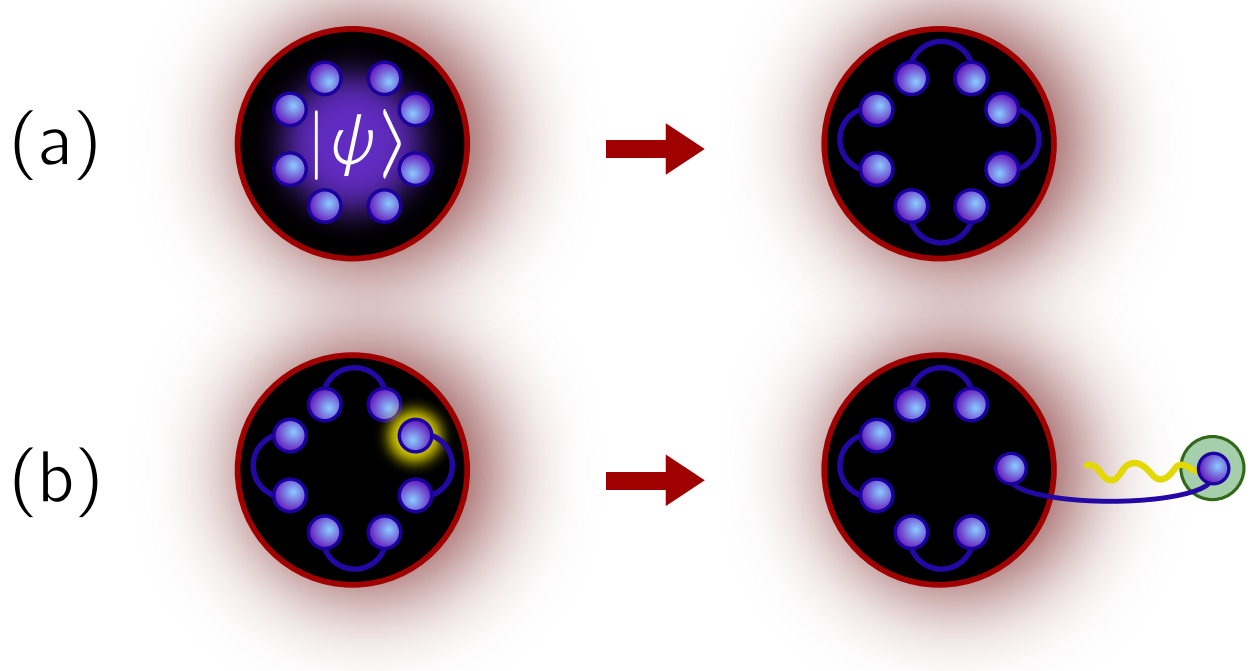

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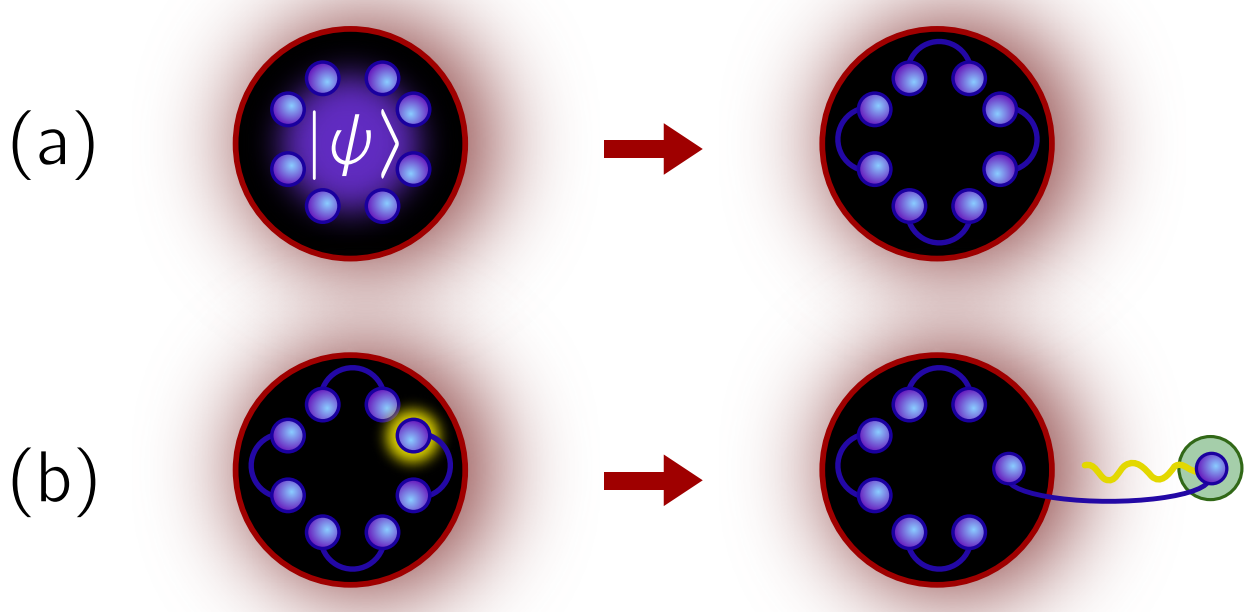

- Note that there are no coins in this model!

Ups and downs

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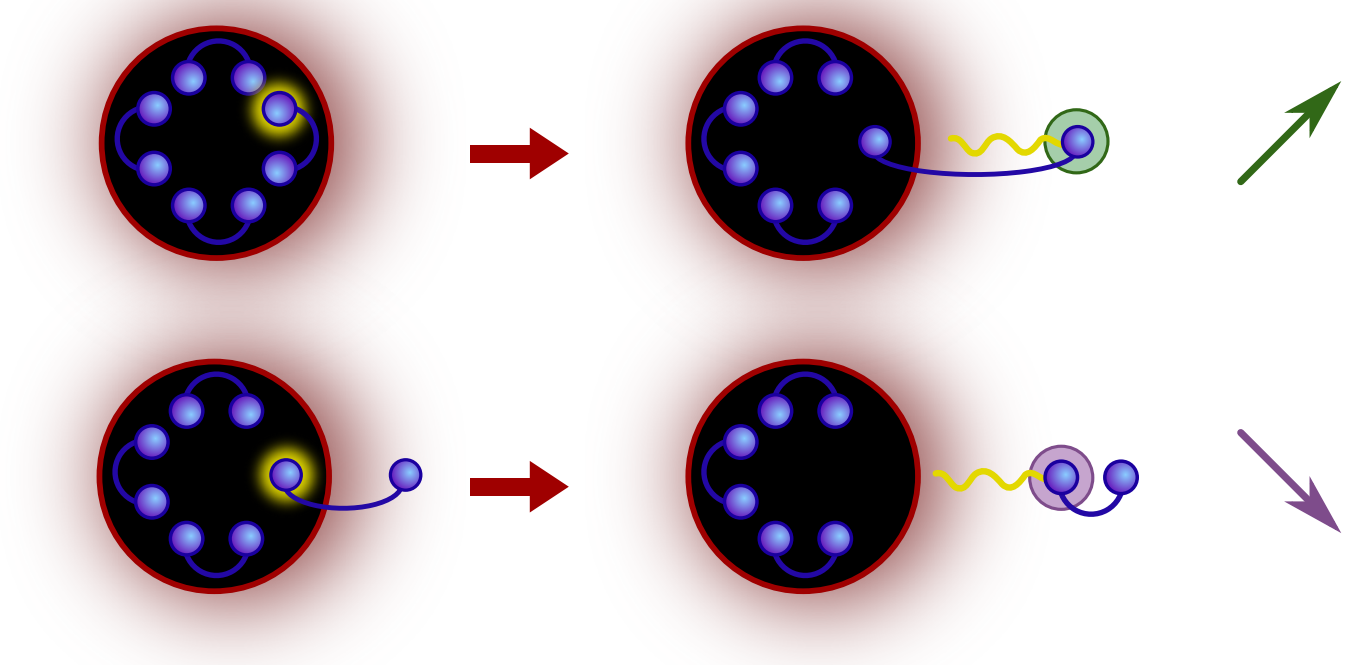

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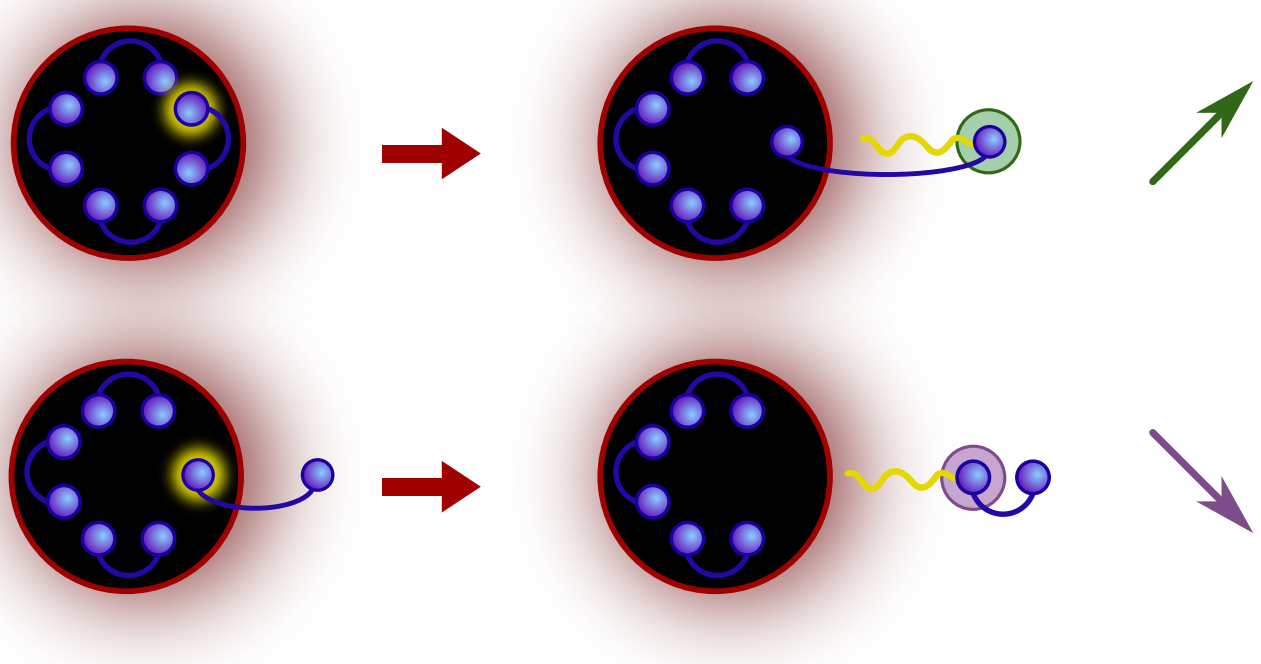

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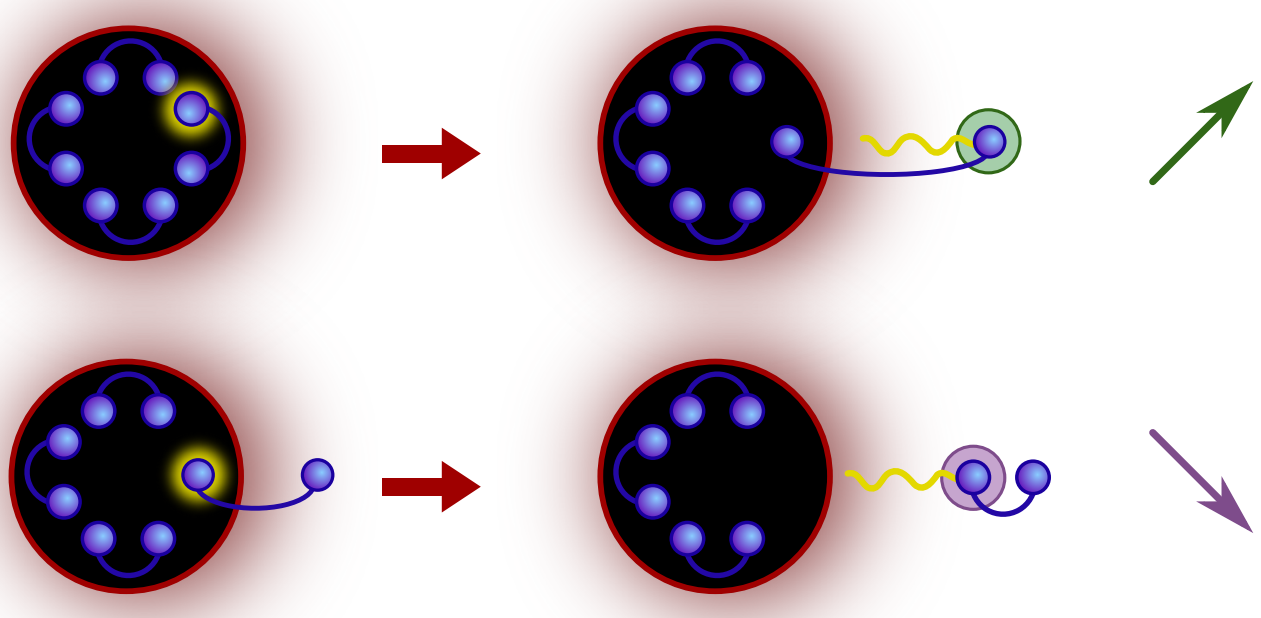

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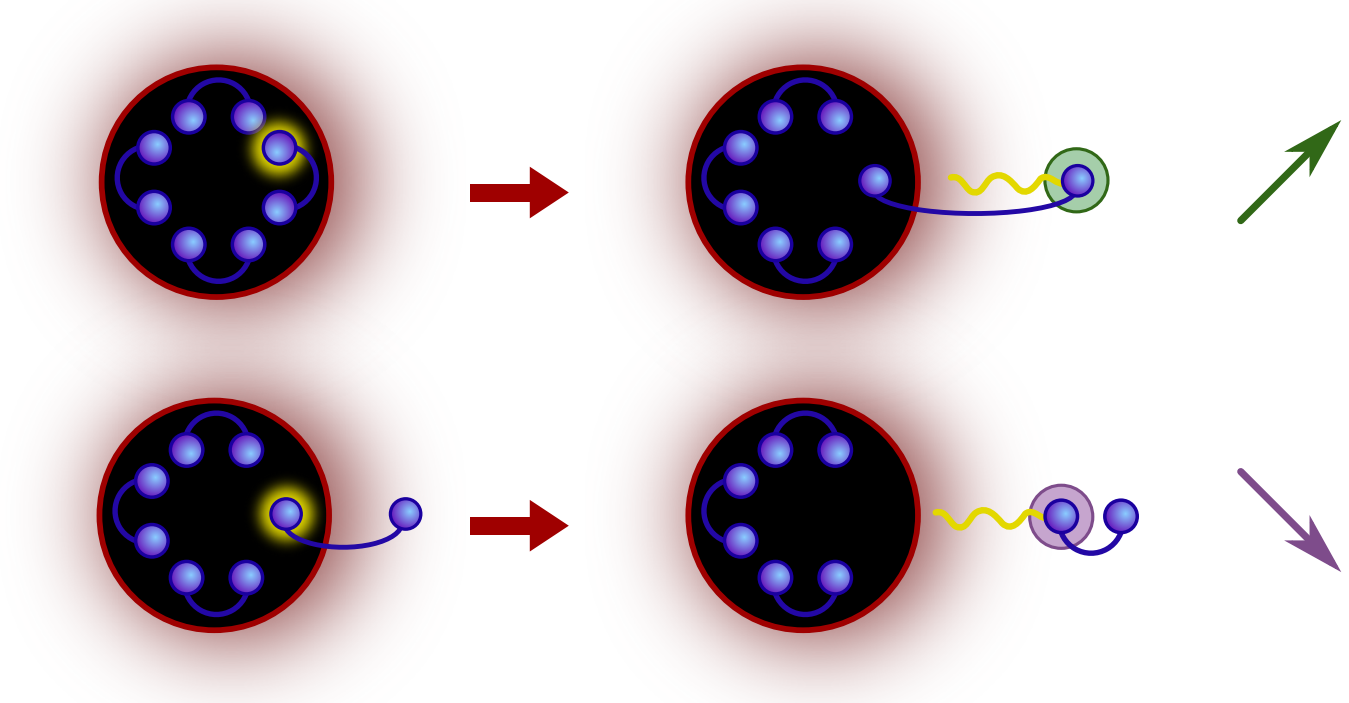

- When the second partner of a "half pair" is emitted, S decreases. Fewer lines cross the horizon.

The Page curve

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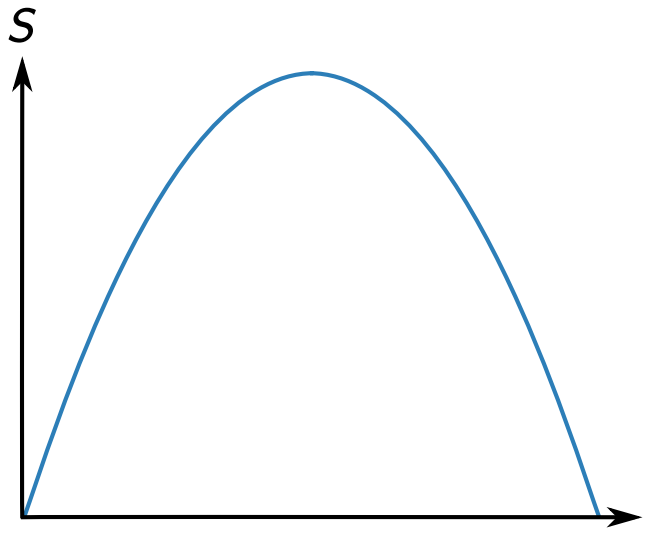

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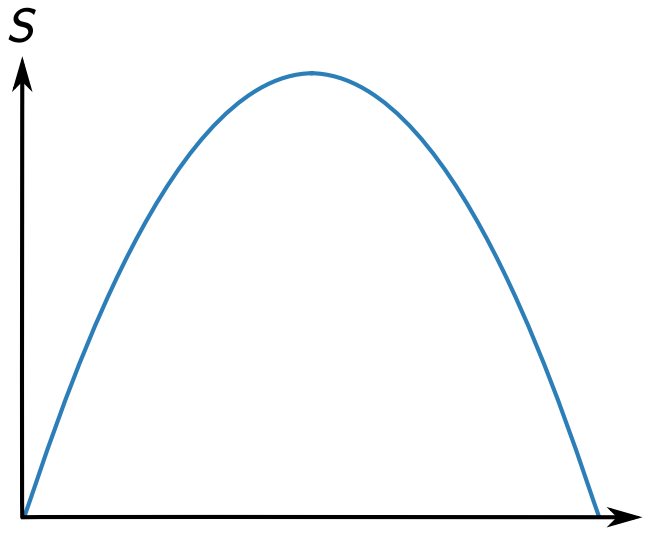

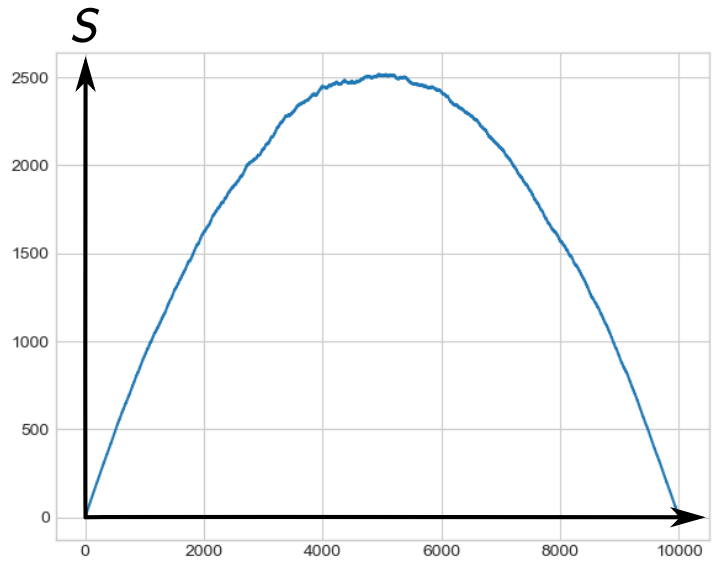

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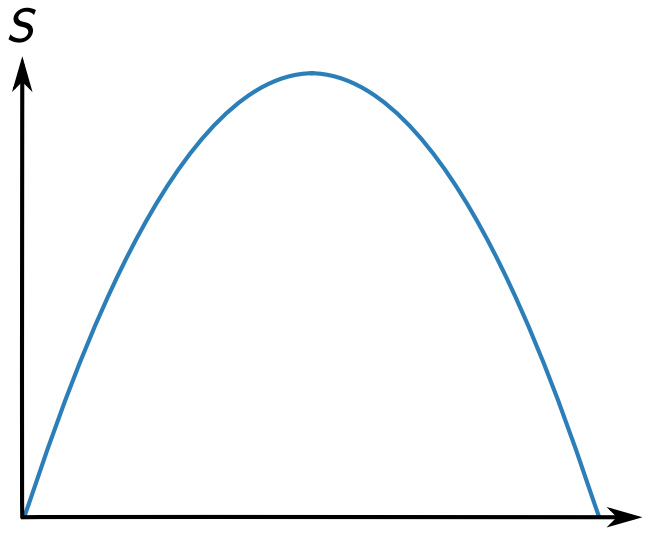

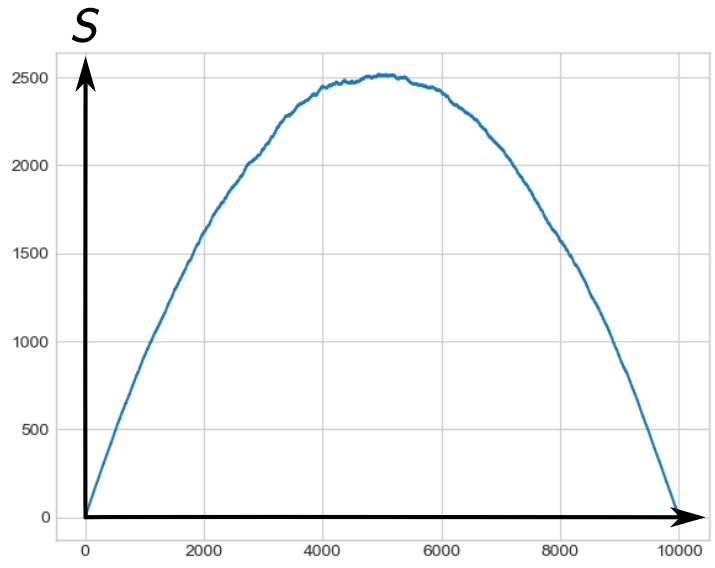

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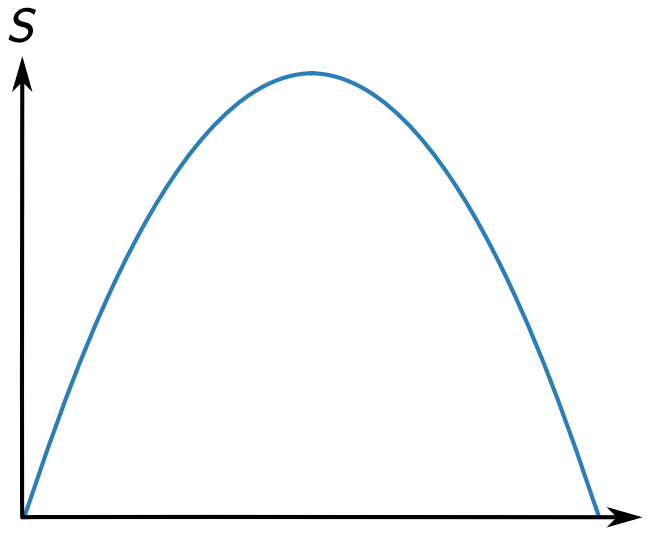

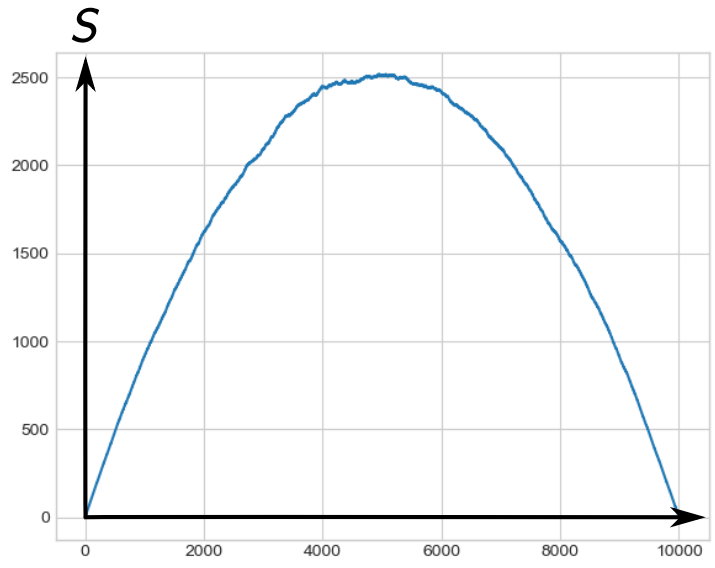

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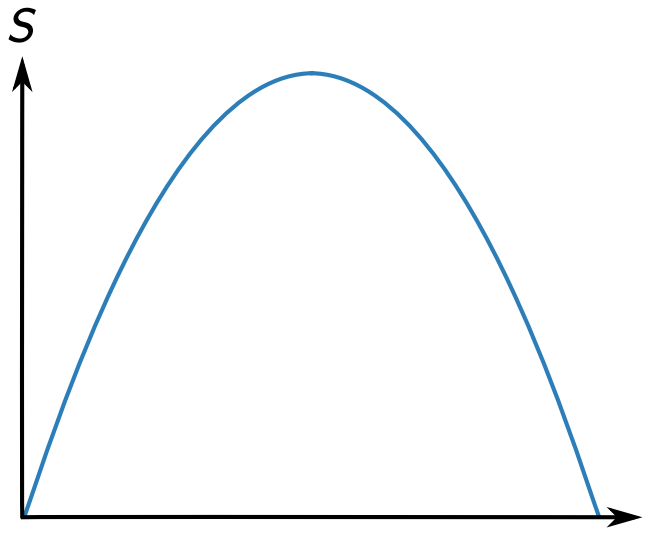

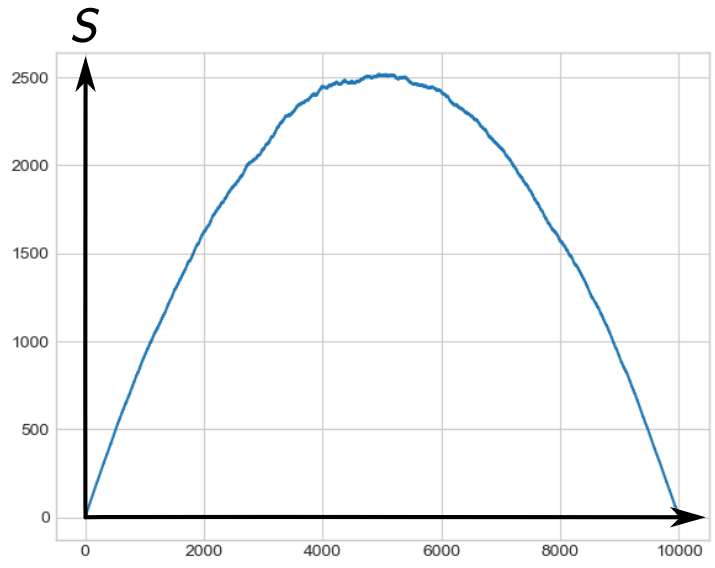

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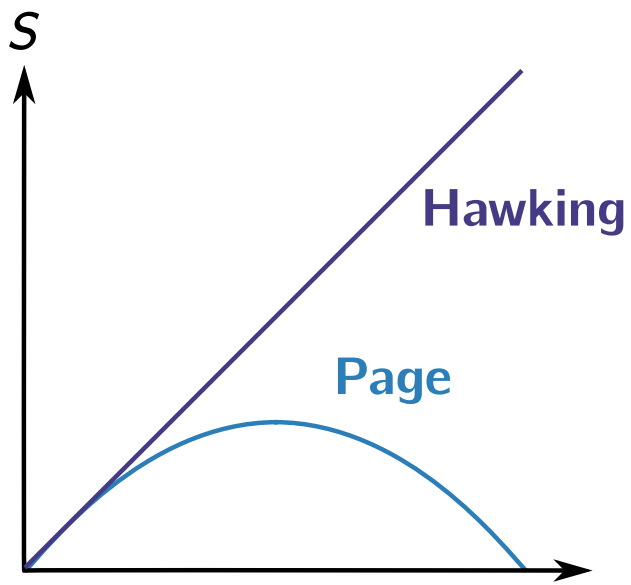

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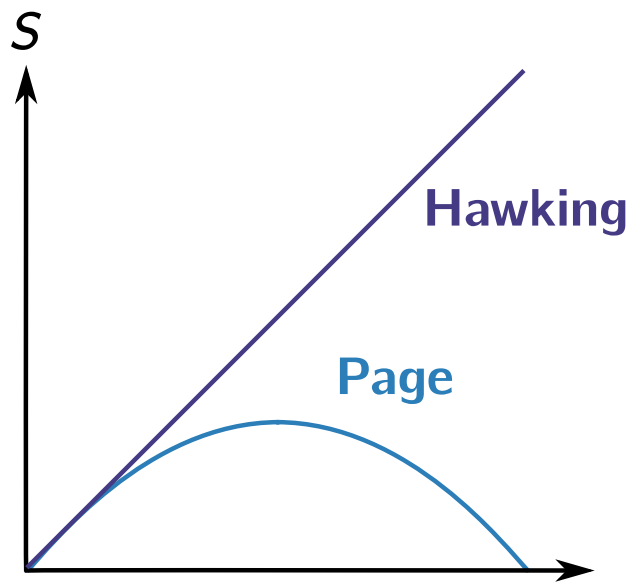

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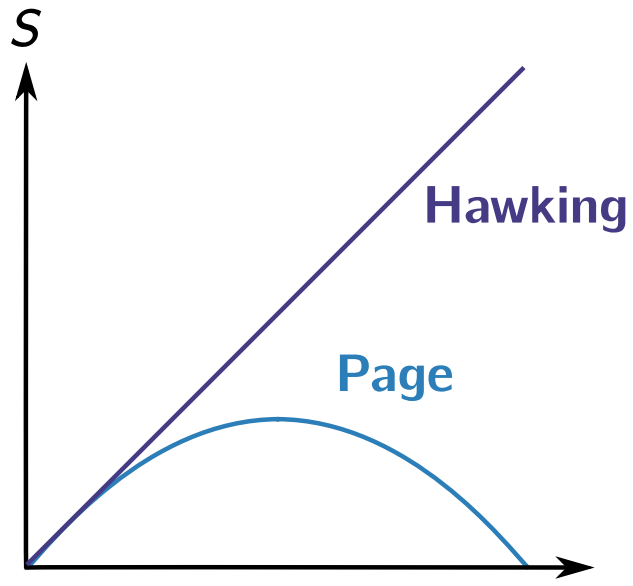

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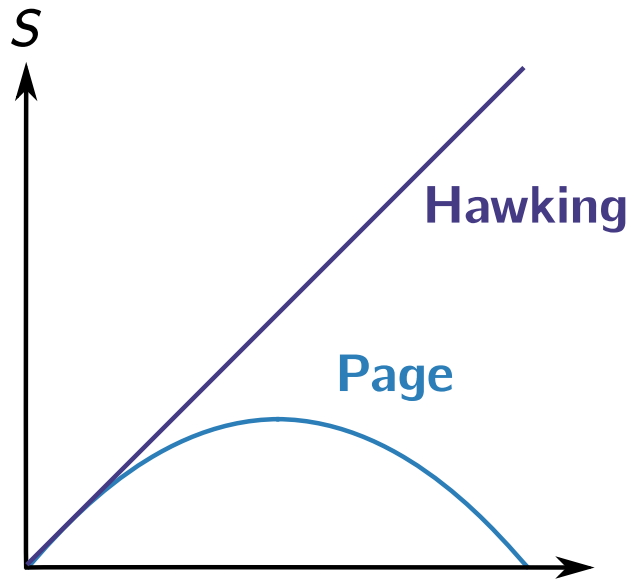

- It comes down to the following question: how should we calculate entanglement entropy from gravity?

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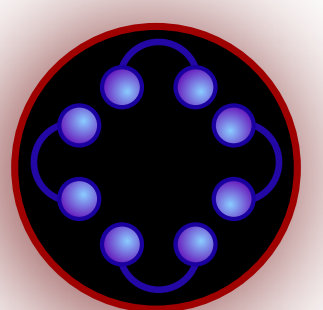

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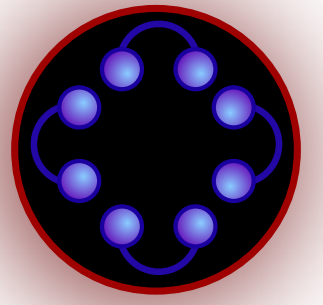

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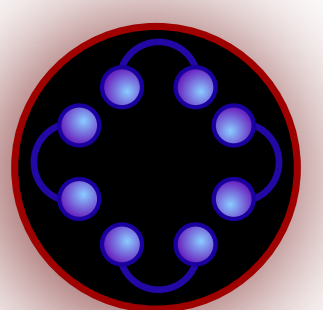

Thanks for listening! Questions?