

ZX-Calculus and PyZX

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Introduction

BT BusinessTech

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Quantum computing, drones and 3D printing – what South African schools could be teaching by 2030. Staff Writer4 March 2021. Subscribe. Department of ...



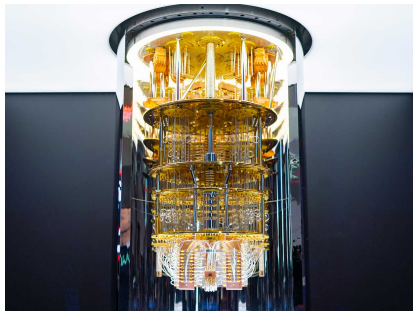
WSJ The Wall Street Journal

The Decade of Quantum Computing Is Upon Us, IBM Exec Says

Quantum computers harness the properties of quantum physics, including superposition and entanglement, to radically speed up complex ...



Some challenges

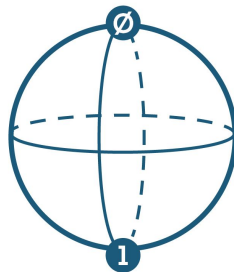


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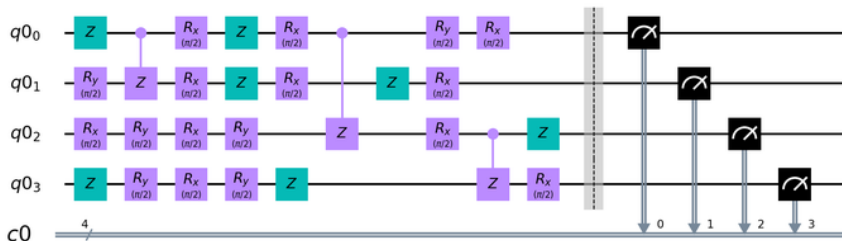
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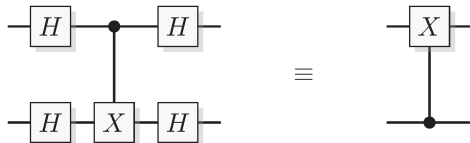


Quantum circuits



Identities

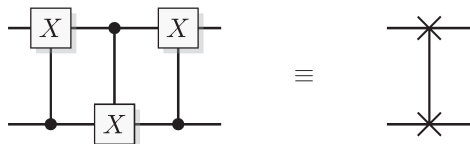
A.



B.



C.



Precise derivation of such rules requires a formal definition of the circuits.

Precise derivation of such rules requires a formal definition of the circuits. This leads us to formalize a diagrammatic calculus for circuits, in order to systematically perform simplification.

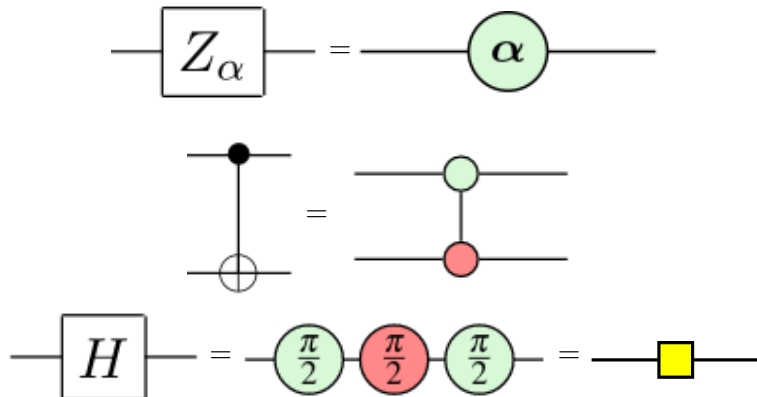
ZX-Calculus



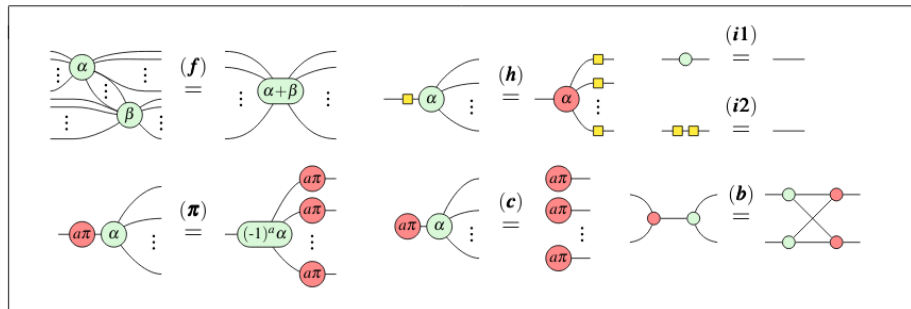
Spiders

$$\begin{array}{c}
 n \left\{ \begin{array}{c} \text{diagram of a green spider with } n \text{ inputs and } m \text{ outputs} \\ \vdots \\ \vdots \end{array} \right\} m = |0\rangle^{\otimes m} \langle 0|^{\otimes n} + e^{i\alpha} |1\rangle^{\otimes m} \langle 0|^{\otimes n} \\
 \\
 n \left\{ \begin{array}{c} \text{diagram of a red spider with } n \text{ inputs and } m \text{ outputs} \\ \vdots \\ \vdots \end{array} \right\} m = |+\rangle^{\otimes m} \langle +|^{\otimes n} + e^{i\alpha} |-\rangle^{\otimes m} \langle -|^{\otimes n}
 \end{array}$$

Open the gates

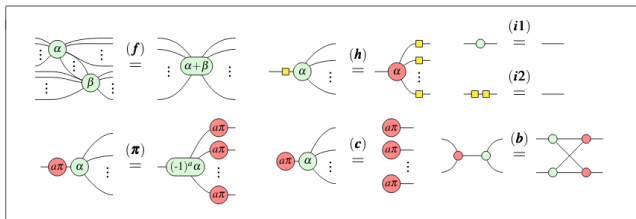
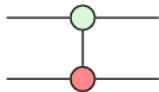
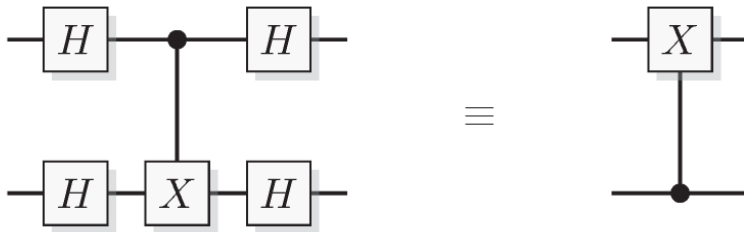


ZX-Calculus rules

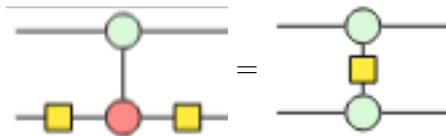


Exercise

A.



Spiders are nasty creatures

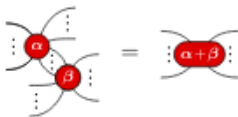
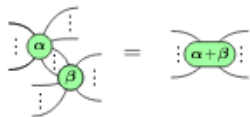


Spiders are nasty creatures



What should we do? Despair?

Clifford ZX-Calculus



Skeleton

