

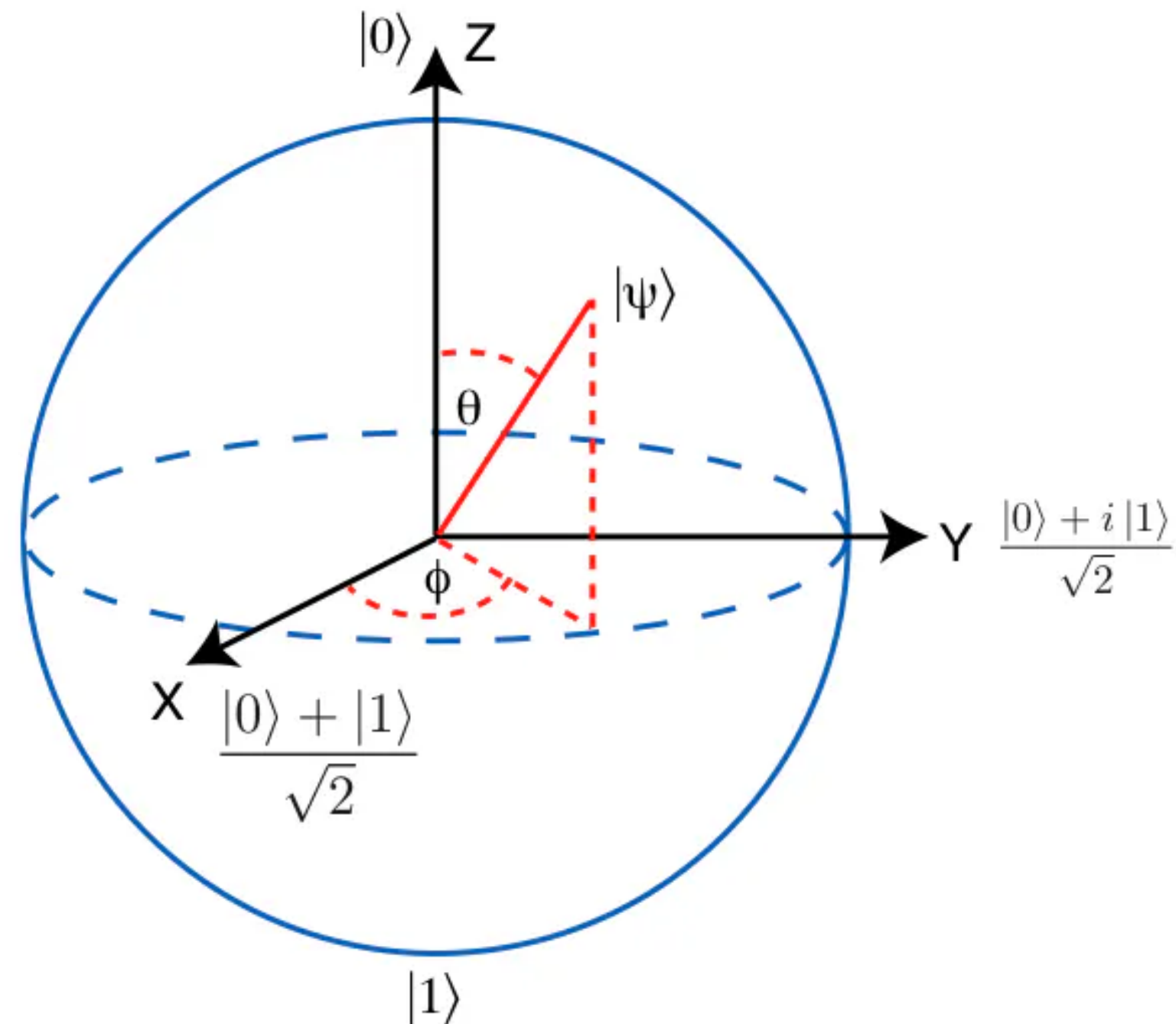


„Strategie sukcesu w algorytmach kwantowych”

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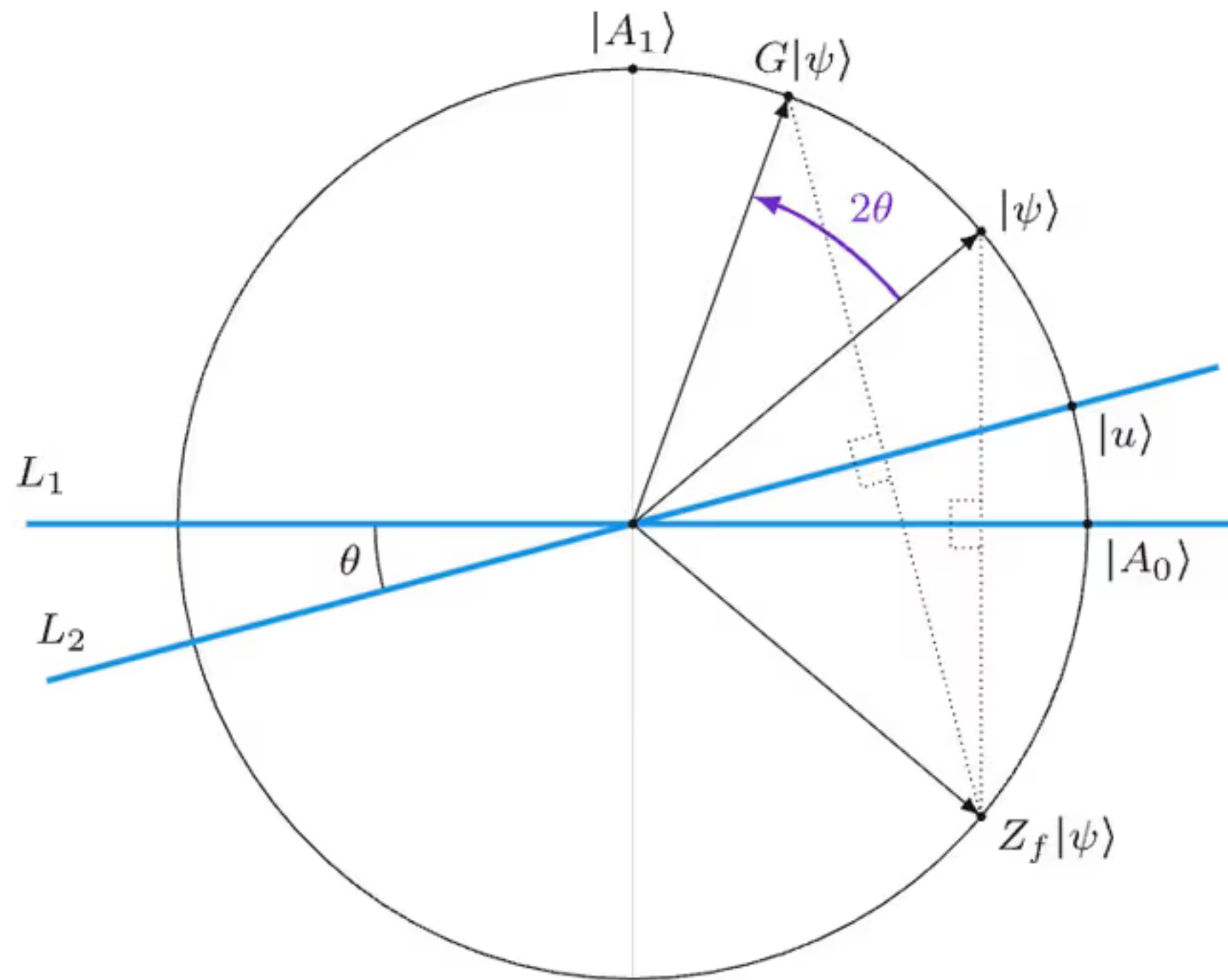
Wojskowa Akademia Techniczna im. gen. Jarosława Dąbrowskiego w Warszawie

$$\cos\left(\frac{\theta}{2}\right)|0\rangle + e^{i\phi}\sin\left(\frac{\theta}{2}\right)|1\rangle = \begin{bmatrix} \cos\left(\frac{\theta}{2}\right) \\ e^{i\phi}\sin\left(\frac{\theta}{2}\right) \end{bmatrix}$$



$$\begin{aligned}U|v\rangle &= e^{i\phi}|v\rangle \\CU((\alpha|0\rangle + \beta|1\rangle) \otimes |v\rangle) \\&= CU(\alpha|0\rangle \otimes |v\rangle + \beta|1\rangle \otimes |v\rangle) \\&= \alpha|0\rangle \otimes I|v\rangle + \beta|1\rangle \otimes U|v\rangle \\&= \alpha|0\rangle \otimes |v\rangle + \beta e^{i\phi}|1\rangle \otimes |v\rangle \\&= (\alpha|0\rangle + \beta e^{i\phi}|1\rangle) \otimes |v\rangle\end{aligned}$$

- Algorytm Deutsch-Jozsy i Bernsteina – Vaziraniego
- Algorytm Grovera



$$G = 2|+\rangle\langle+| - I$$

- Algorytm Grovera
- Algorytm Dürra-Høyer
- Algorytm Brassarda-Høyer-Tappa

$$\text{QFT}|x\rangle = \frac{1}{\sqrt{N}} \sum_{y=0}^{N-1} e^{\frac{2\pi i xy}{N}} |y\rangle$$

$$QFT = \frac{1}{\sqrt{2^n}} \begin{bmatrix} 1 & 1 & 1 & 1 & \dots & 1 \\ 1 & \omega & \omega^2 & \omega^3 & \dots & \omega^{2^n-1} \\ 1 & \omega^2 & \omega^4 & \omega^6 & \dots & \omega^{2(2^n-1)} \\ 1 & \omega^3 & \omega^6 & \omega^9 & \dots & \omega^{3(2^n-1)} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 1 & \omega^{2^n-1} & \omega^{2(2^n-1)} & \omega^{3(2^n-1)} & \dots & \omega^{(2^n-1)(2^n-1)} \end{bmatrix}$$

$$\omega = e^{2\pi i/2^n}$$

- Kwantowa Estymacja Fazy
- Algorytm Shora
- Sumator Drapera

Klasycznie

$$x \rightarrow f(x)$$

x	OR	AND
00	0	0
01	1	0
10	1	0
11	1	1

Kwantowo

$$|x\rangle|y\rangle \rightarrow |x\rangle|y \oplus f(x)\rangle$$

x	OR	AND
000	000	000
010	011	010
100	101	100
110	111	111
001	001	001
011	010	011
101	100	101
111	110	110

$$|x\rangle|0\rangle \xrightarrow{U} |x\rangle|f(x)\rangle$$

$$\downarrow \text{Phase}(f(x))$$

$$e^{i\theta_{f(x)}}|x\rangle|0\rangle \xleftarrow{U^{-1}} e^{i\theta_{f(x)}}|x\rangle|f(x)\rangle$$

$$\frac{1}{\sqrt{3}} (|000\rangle + |001\rangle + |111\rangle)$$

Pomiar trzeciego kubit



Wynik 0

$$|00\rangle \otimes |0\rangle$$



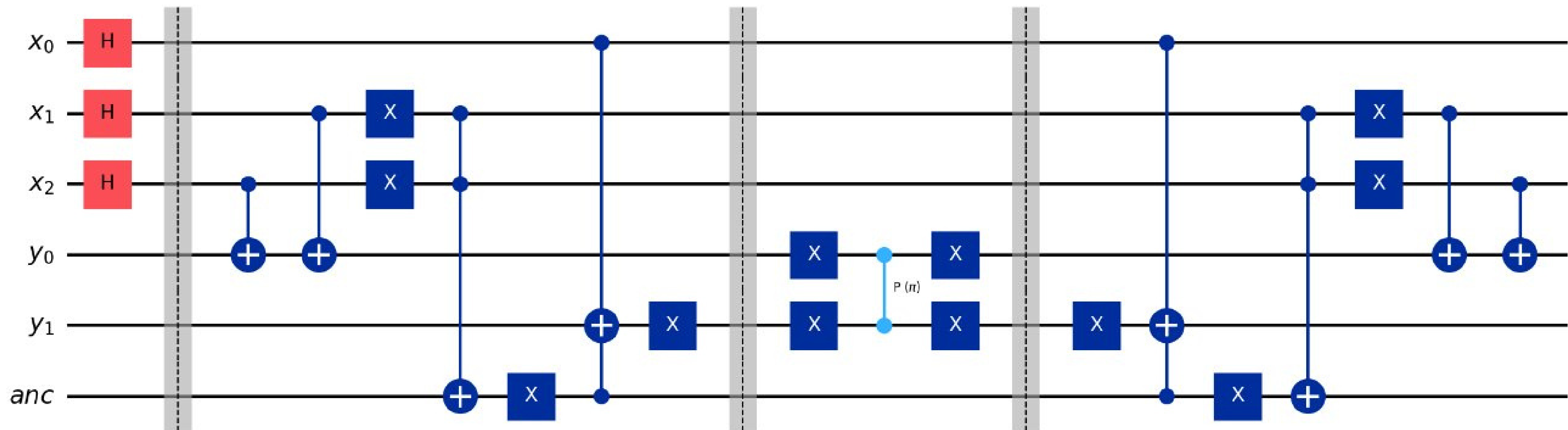
Wynik 1

$$\frac{1}{\sqrt{2}} (|00\rangle + |11\rangle) \otimes |1\rangle$$

- Algorytm Simona
- Kwantowa Korekcja Błędów
- Protokół Teleportacji Stanu Kwantowego

$$y_0(x_0, x_1, x_2) = x_1 \oplus x_2$$

$$y_1(x_0, x_1, x_2) = \overline{x_0} \vee (\overline{x_1} \wedge \overline{x_2})$$



WAT | WYDZIAŁ CYBERNETYKI

Dziękuję za uwagę!