

# DFT Vs Quantum FT.

(4)

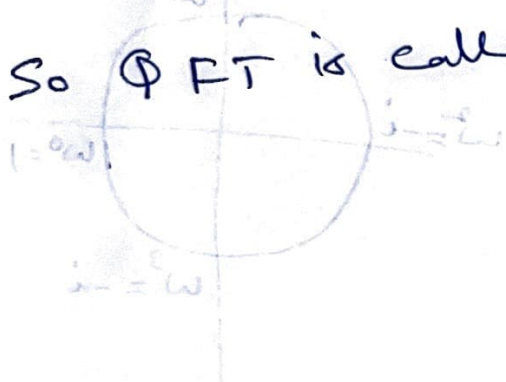
✓ In QFT ~~we~~ don't get the whole vector  $\phi$  as output  
But ~~we~~ get only ~~one~~ <sup>one</sup> value in the vector with  
some probability.

~~we~~ get  $|0\rangle$  with a prob.  $\left(\frac{1}{\sqrt{2}}\right)^2 = \frac{1}{2}$

or  $|1\rangle$  with a prob  $\left|\frac{1-i}{2\sqrt{2}}\right|^2$

or  $|3\rangle$  with a prob  $\left|\frac{1+i}{2\sqrt{2}}\right|^2$

So QFT is called Quantum Fourier Sampling



$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ \omega & \omega^2 & \omega & 1 \\ \omega^2 & \omega & \omega^2 & 1 \\ \omega & \omega^2 & \omega & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ \omega & \omega^2 & \omega & 1 \\ \omega^2 & \omega & \omega^2 & 1 \\ \omega & \omega^2 & \omega & 1 \end{bmatrix}$$

$$\langle \Phi | = \begin{bmatrix} -i \\ i-1 \\ 0 \\ i+1 \end{bmatrix} \frac{1}{\sqrt{4}} = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 \end{bmatrix} \frac{1}{\sqrt{4}} \begin{bmatrix} 1 & 1 & 1 & 1 \\ \omega & \omega^2 & \omega & 1 \\ \omega^2 & \omega & \omega^2 & 1 \\ \omega & \omega^2 & \omega & 1 \end{bmatrix} \frac{1}{\sqrt{4}} = \langle \Psi | \frac{1}{\sqrt{4}}$$

$$\langle 0 | \frac{1}{\sqrt{4}} + \langle 1 | \frac{1}{\sqrt{4}} + \langle 0 | \frac{1}{\sqrt{4}} = \langle \Phi |$$