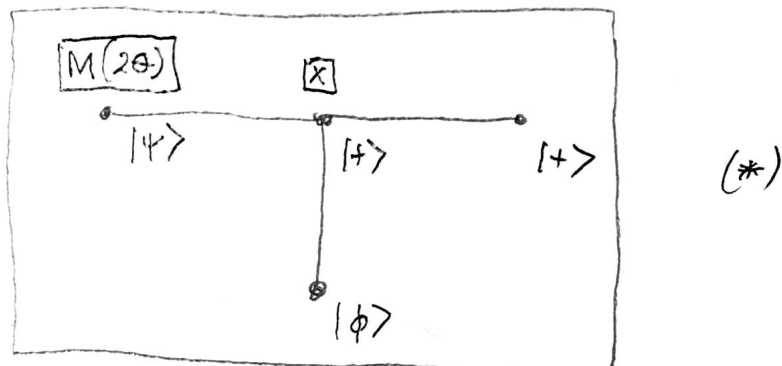


# Modifying the CNOT measurement pattern

Consider



let  $|\psi\rangle = a|0\rangle + b|1\rangle$  ;  $|\phi\rangle = c|0\rangle + d|1\rangle$

then the positive branch of the outcome is

$$ac|00\rangle + e^{-2i\theta}bc|01\rangle + e^{-2i\theta}cd|10\rangle + ad|11\rangle$$

On the other hand, we want instead

$$e^{i\theta\sigma_z \otimes \sigma_z} |\phi\psi\rangle \approx ac|00\rangle + e^{-2i\theta}bc|01\rangle + e^{-2i\theta}cd|10\rangle + bd|11\rangle$$

$\Rightarrow$  To get  $e^{i\theta\sigma_z \otimes \sigma_z} |\phi\psi\rangle$ , we use CNOT, followed by (\*)  
to that

$ac 00\rangle$ $+ bc 01\rangle$ $+ ad 10\rangle$ $+ bd 11\rangle$	$\xrightarrow{\text{CNOT}}$	$ac 00\rangle$ $+ bc 01\rangle$ $+ cd 10\rangle$ $+ ad 11\rangle$	$\xrightarrow{(*)}$	$ac 00\rangle$ $+ bce^{-2i\theta} 01\rangle$ $+ ade^{-2i\theta} 10\rangle$ $+ bd 11\rangle$	$= e^{i\theta\sigma_z \otimes \sigma_z}  \phi\psi\rangle$
$\downarrow$ 2 simultaneous measurements		$\downarrow$ 2 simultaneous measurements.			