

Results from

# Noise Amplification in VQE Optimized Circuit (4.1)

Noise Amplified by Randomized addition of pairs of similar gates

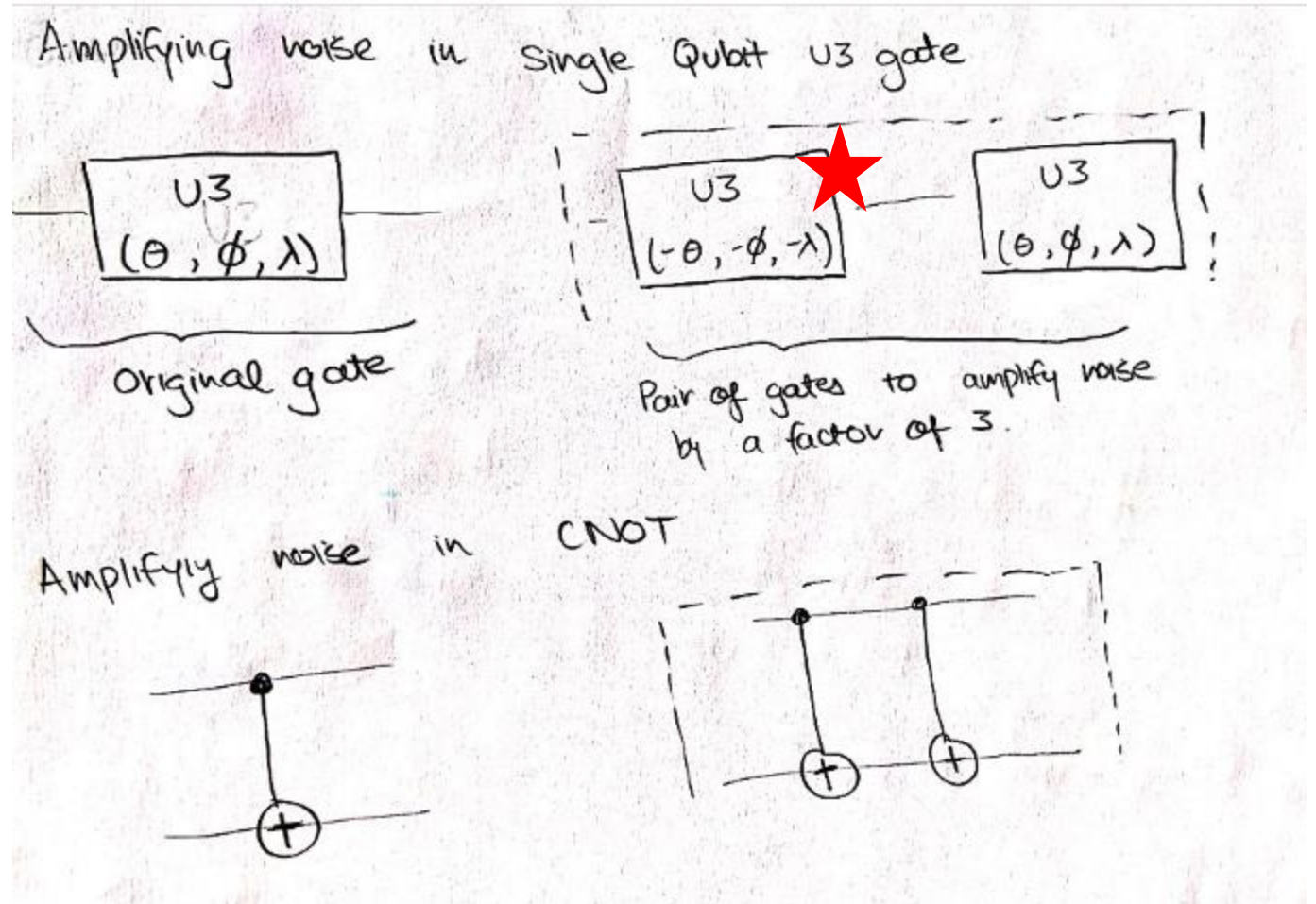
Meeting with Professor Schnetzer and Rikab

August 10, 2020

# Noise Amplification Procedure

- Correction:

$$\begin{aligned}
 &U3^{-1}(\theta, \phi, \lambda) \\
 &= \\
 &U3(-\theta, -\pi - \lambda, -\pi - \phi)
 \end{aligned}$$



# Noise Amplification Rate $\neq$ Probability of adding a pair of gates

Amplifying noise rate by  $1 \leq c \leq 3$ .

What we need to find: what is the probability with which we add a pair of gates after a given gate to amplify the overall noise rate  $\lambda$  by  $c$ ?

Let's say this probability is  $d$

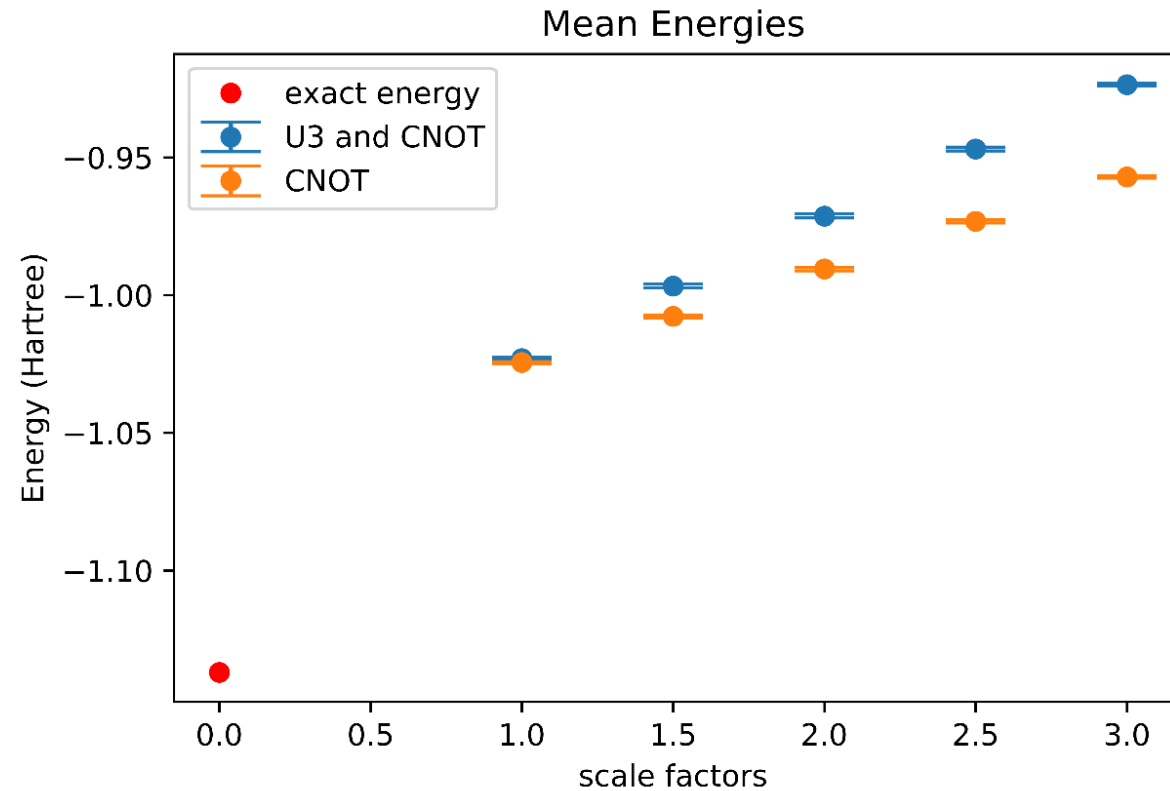
$$\underbrace{d \cdot 3\lambda}_{\text{Probability with which we add a pair of similar gates after a given gate}} + \underbrace{(1-d) \cdot \lambda}_{\text{Probability with which we leave that gate as it is}} = c\lambda$$

$$\Rightarrow d = \frac{c-1}{2}$$

So to amplify the noise rate by  $c=1.5$ , we have to add a pair of similar gates after a given gate with 0.25 probability.

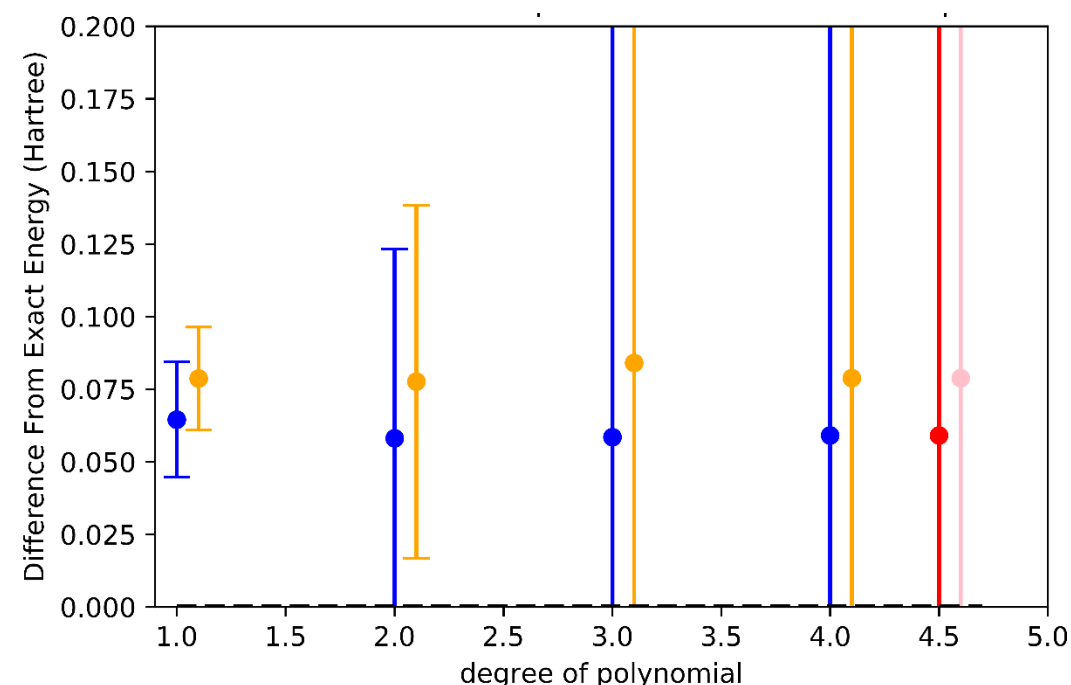
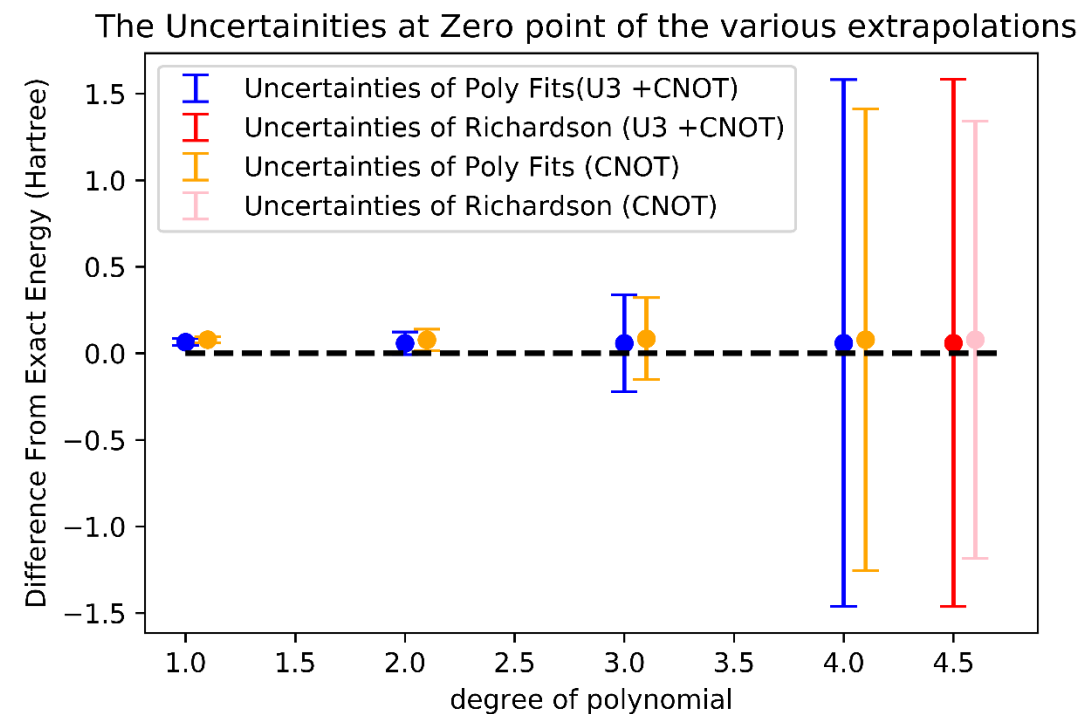
# Adding a pair of gates randomly

**London Noise Simulator**  
**1000 samples**



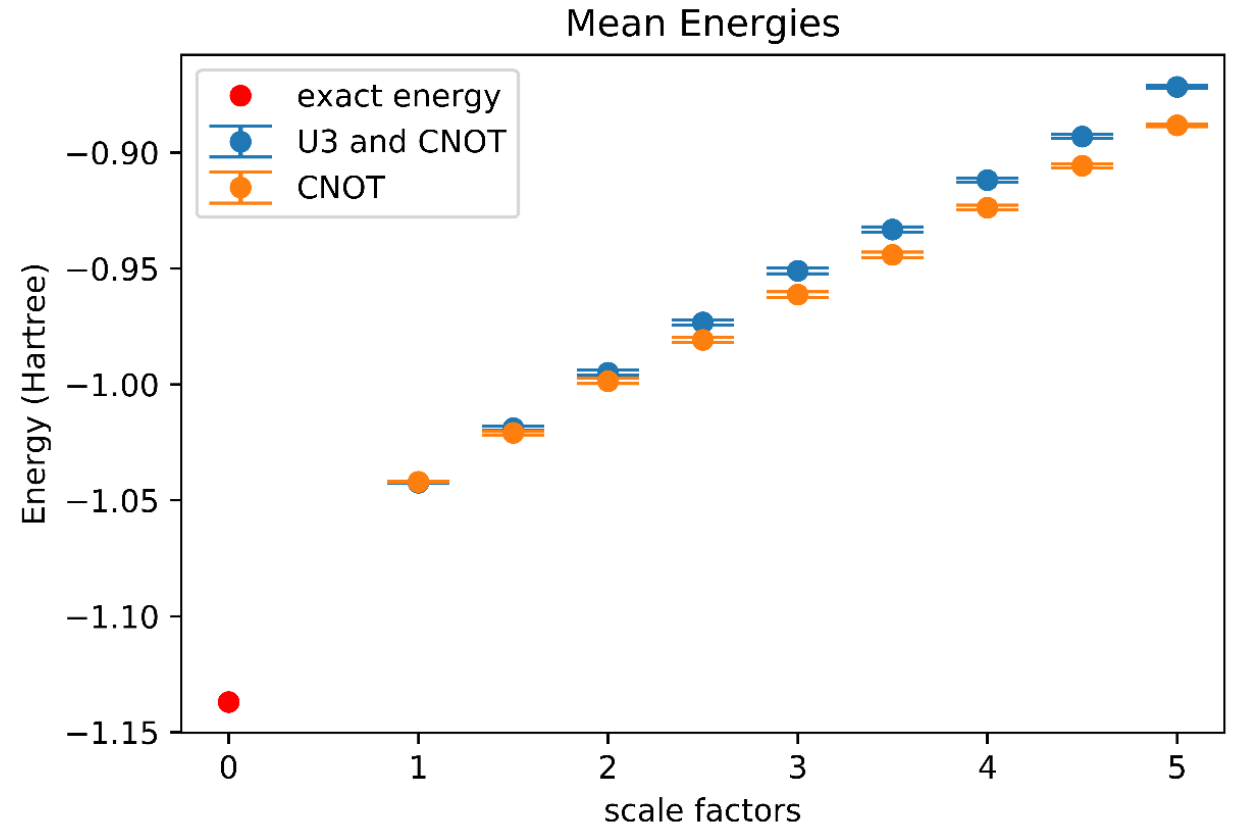
Adding a pair of  
gates randomly

## Extrapolation



Adding *2 pairs* of  
gates randomly

**London Noise Simulator**  
**1000 samples**



Adding *2 pairs* of  
gates randomly

## Extrapolation

