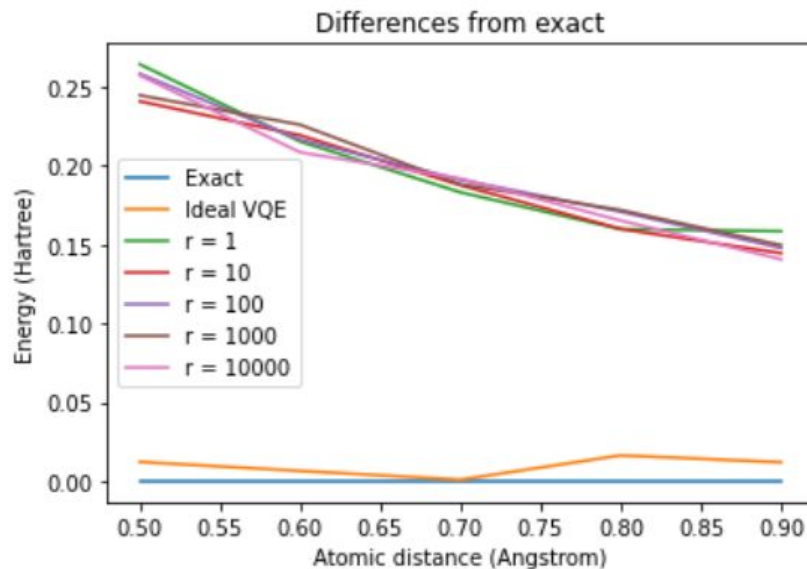# Statistical Analysis + Twirling VQE (2)

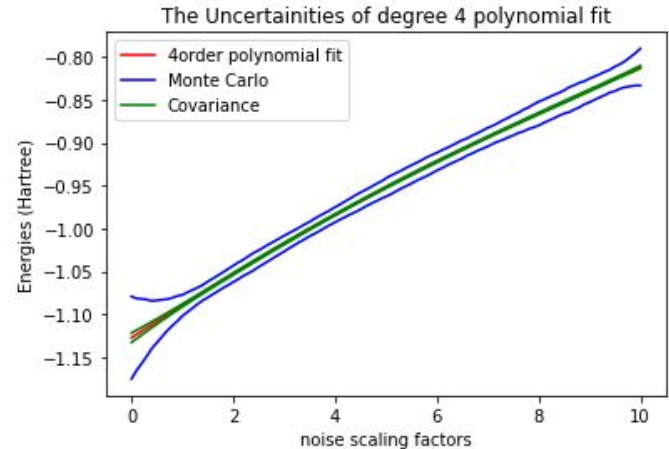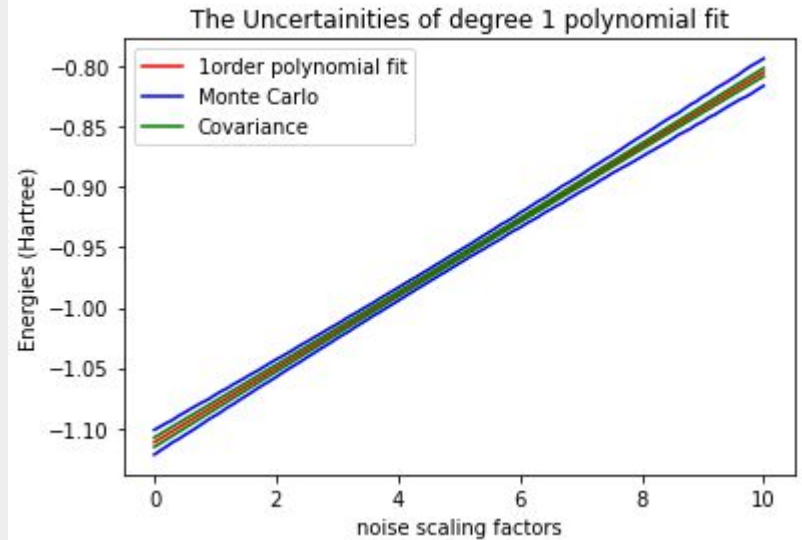Meeting with Professor Schnetzer and Rikab
July 9, 2020

Twirling VQE

There has to be a bug in how I am implementing twirling

Possible Experiment to validate whether Twirling works: Find the expectation value of hamiltonian for a set of parameters and see whether twirling+error simulation does in fact change the expectation value.
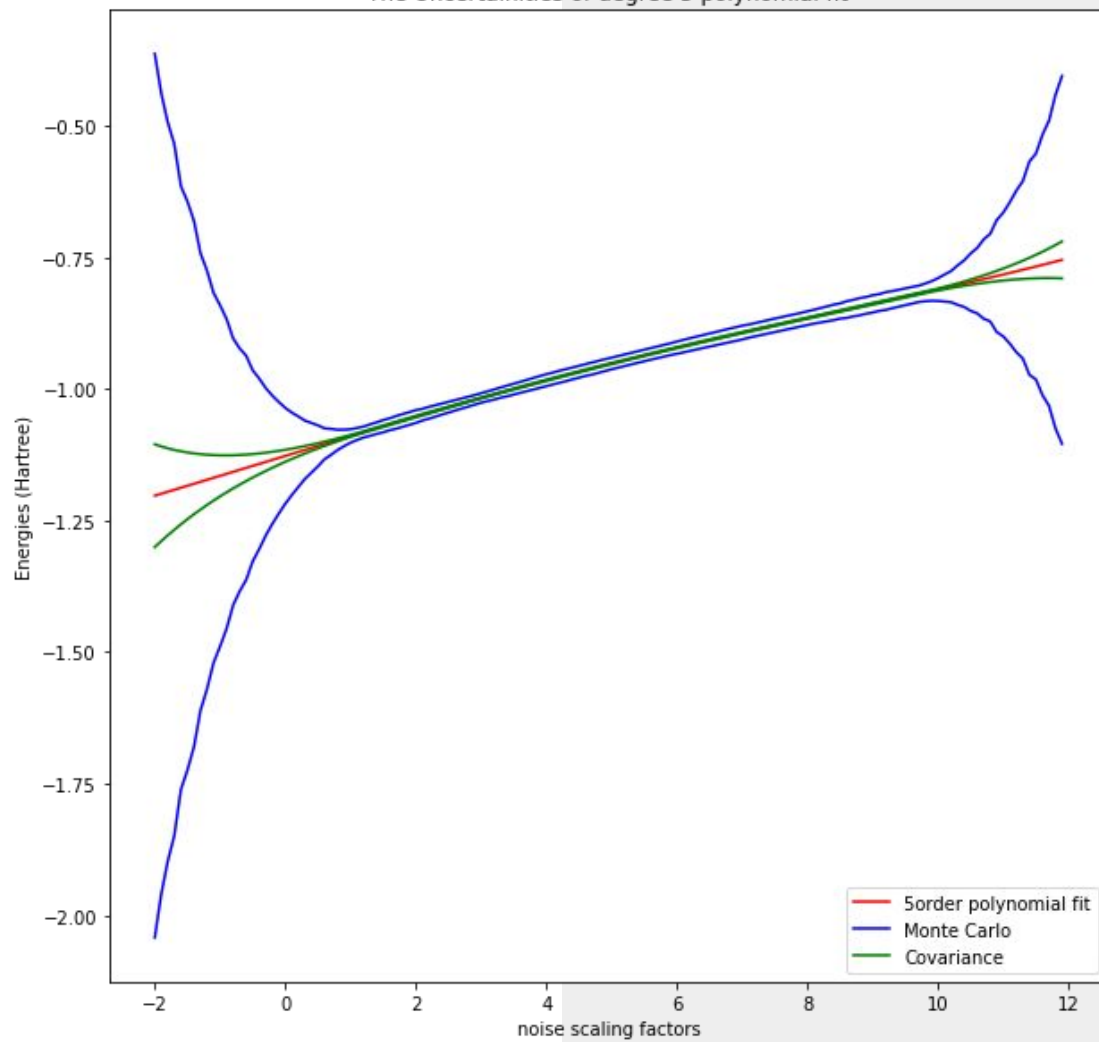

Differences from exact

Uncertainties Analysis

Covariance method vs Monte Carlo method: Fits look nicer but expected monte carlo to be same as covariance curves

The Uncertainities of degree 1 polynomial fit

The Uncertainities of degree 4 polynomial fit

The Uncertainities of degree 5 polynomial fit

Uncertainties Analysis

Using either methods for computing uncertainties, it seems like lower degree fits are better (based on F stats)

- Covariance method however produces better chi square/ ddof stats

Using Monte Carlo

```
F stat for degree 1 vs 2:
105.15449043669472
```
p val is 0.9999986572802235
```
More param is good!
F stat for degree 2 vs 3:
4.206608114500793
```
p val is 0.949998685603885
```
More param is good!
F stat for degree 3 vs 4:
0.9788138542789813
```
p val is 0.4799051665312492
```
More param is good!
F stat for degree 4 vs 5:
0.9120768885555193
```
p val is 0.44912182955059704
```
More param is good!
F stat for degree 5 vs 6:
0.7709414854889374
```
p val is 0.390440111130875
```
More param is good!
F stat for degree 6 vs 7:
0.5508868893737991
```
p val is 0.3043417579214433
```
More param is good!
F stat for degree 7 vs 8:
0.44971336341776086
```
p val is 0.2744142787838587
```
More param is good!
```

Using Covariance Method

```
F stat for degree 1 vs 2:
28.9195810714569
```
p val is 0.9998914032139553
```
More param is good!
F stat for degree 2 vs 3:
1.959356447669918
```
p val is 0.7847262537090082
```
More param is good!
F stat for degree 3 vs 4:
0.4359036892257903
```
p val is 0.1705606725442941
```
More param is good!
F stat for degree 4 vs 5:
0.5311048062283993
```
p val is 0.25164945582598264
```
More param is good!
F stat for degree 5 vs 6:
0.6844777798979985
```
p val is 0.3513606995611241
```
More param is good!
F stat for degree 6 vs 7:
0.8181534785123071
```
p val is 0.40901703395410693
```
More param is good!
F stat for degree 7 vs 8:
0.8476821033624602
```
p val is 0.39089625237666414
```
More param is good!
```