

Journal Two

Eesh Gupta

June 16, 2020

- What has been the most significant challenge you have faced in the research environment? This could either be in your research activities or in terms of personal and professional relationships.

Managing Autonomy: Having built a good relationship with my faculty mentor over the course of spring semester and now this summer, I have a greater control over designing experiments, selecting research papers for “deep-reading”, and choosing which concepts to make a comprehensive report on. While my faculty mentor still guides me through the rough spots, the wheel is in my hands most of the times. Such autonomy, however, translates to an increased sense of pressure to produce “progress”. And this can get overwhelming, especially when some experiment fails to produce meaningful results or when a topic becomes too hard to understand. However, having my Gandalf poster (Figure 1) on the opposite wall and “the Avengers” soundtrack buzzing in my room, I tell myself, “Whatever it takes!” And I get moving.

Dealing with Distractions: I miss Library of Science and Medicine, mostly because I can’t get myself to watch a 1.5 hour movie in the middle of a study session in the quiet floor. Yet, that’s not true in my current workplace. While I do try to learn more about myself and schedule my day accordingly, I can get it wrong, especially on Fridays. For the past 2 weekends, I have had to work extra hours on Sunday because Friday didn’t go so well! However, with every passing day, I get more comfortable with working 6-7 hours a day as long as I spread my hours sufficiently.

- How has research differed from your expectations?

Art of Explaining: I did not expect that a large part of my research will be constantly explaining it to myself and others. Properly reasoning my research project is invaluable. I have experienced several instances of embarrassment in my meetings with my faculty mentor and other professors. The reason? I didn’t think enough about my methods, forgot to review small yet significant details like units on a graph, assumed something was true despite lack of evidence, etc. I



Figure 1: My inspirational “Gandalf” poster!

often fool myself into assuming that I understand something when I really don’t.

For example, during a presentation to a research group from the chemistry department, I was asked whether the subject of my talk - Variational Quantum Eigensolver- could solve the electronic structure problem *within* chemical accuracy. In the context of my work, this question was a simple yet important one, one that I forgot to ask myself. So naturally, I fumbled for a few minutes. Fortunately, the leader of that research group saved me from further embarrassment. Whew!

The lesson from these experiences is to be really critical when learning a concept or doing an experiment. Being inquisitive and transparent are some of the things I can do to make my explanations logically sound.

- **What has been your greatest success or accomplishment thus far?**

Exciting Experiments: Since quantum computers can be efficiently accessed through IBM Cloud, I can run experiments efficiently and retrieve results in a matter of seconds. This means that I can go

beyond the assertions made by research papers and actually test out the proposed techniques in real time. Yet, to do so, one needs to understand the IBM code works. This can be stressful. However, sometimes things click and they have done so several times this week! Shown below are results from an experiment testing whether I can use “noisy” or error sensitive results to produce a better result i.e. a curve that is closer to the ideal curve. The graph below shows how it is possible to extrapolate from the “noisy” orange and green curves to produce a better result (red curve) which is closer to the ideal result (blue curve). The implications of such cheeky trick are huge: we can get somewhat accurate answers despite the “noisiness” of our current quantum devices.

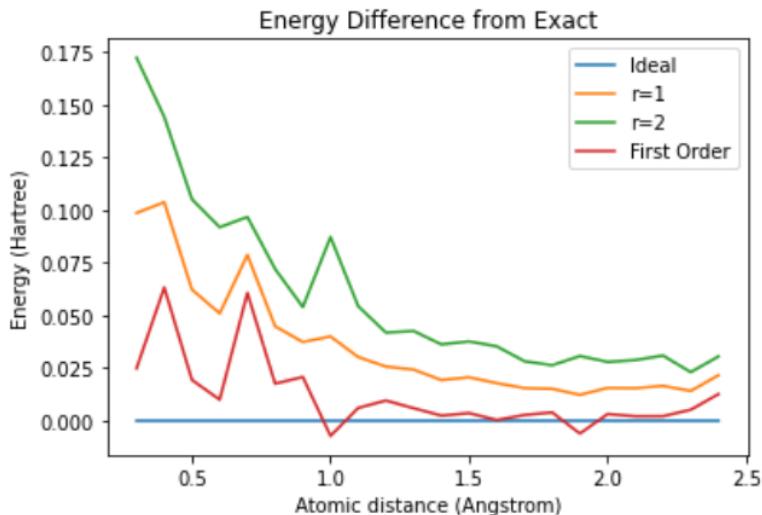


Figure 2: Results from an extrapolation experiment on the energy dissociation curves of hydrogen H_2 molecule.

I feel proud of this result because it seemed hard to replicate when I initially read it in a paper. But having simulated such technique, I can now investigate more complicated techniques and hopefully get to the cutting edge, from where I can make new discoveries!