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### **Abstract**

We note that doing freeze-core twice, we obtain an incorrect value for energy. When you do freeze-core once, you get around  $-7.8$  hartree, whereas doing it twice, you get something closer to 0.

But doing freeze-core twice is enormously expensive- it involves 10 qubits! Doing freeze-core twice gets it down to eight qubits. The IBM paper manages to get it down to four! How can we do that without sacrificing significantly the accuracy?

Furthermore, note that in the IBM paper, they do it not with 1.57 but with 2.5 Armstrongs, arguing that the VQEs struggle with that. So I've added that as an option.

I manually included the 4-qubit Hamiltonian in the project to see what value it gives us as the lowest energy.