An Investigation of Chaos Theory Using Supercomputing Techniques

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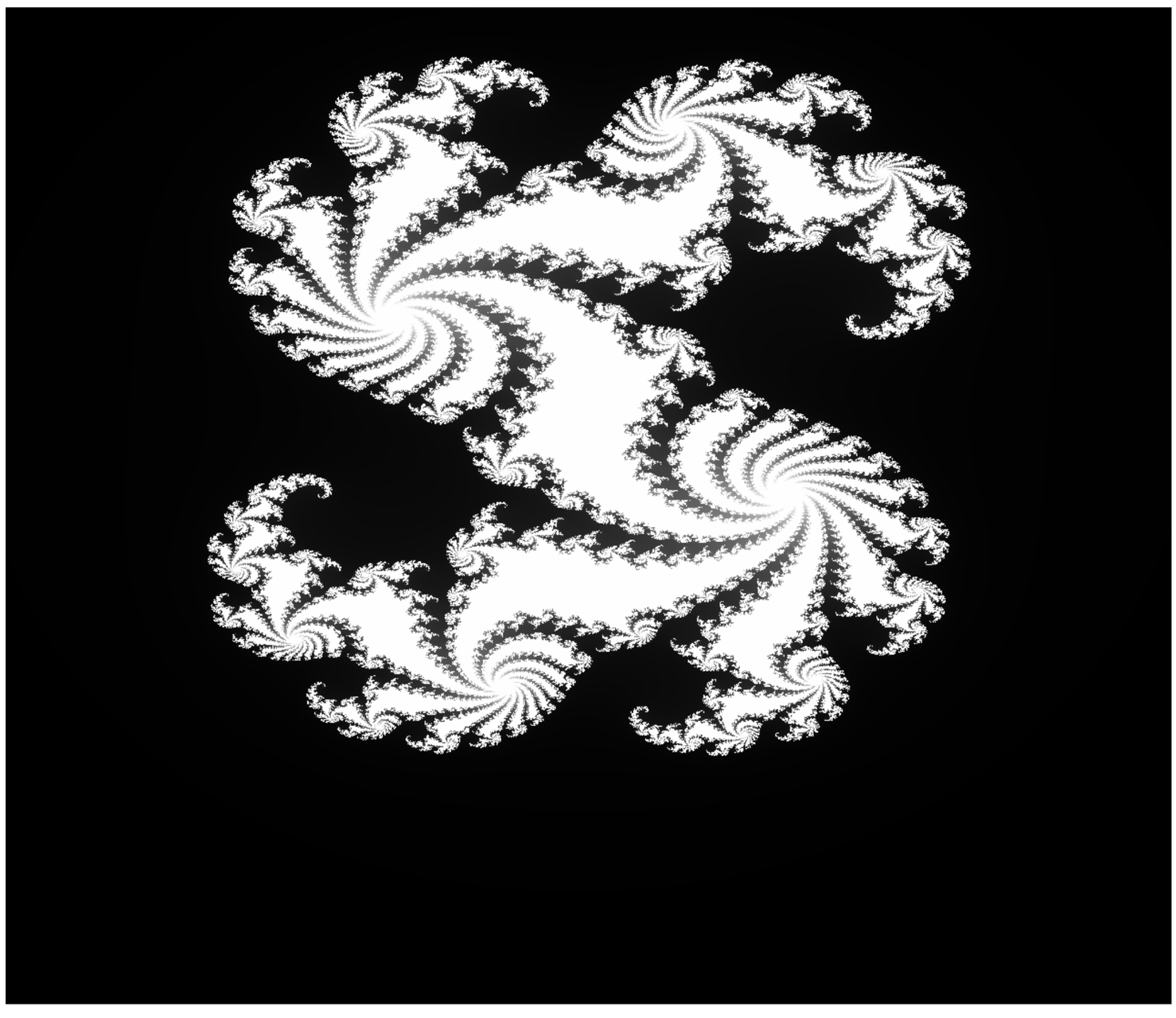
Introduction

Chaos theory is the study of dynamic systems in which small differences in the environment, can create large, unpredictable results. The classic example of chaos theory is the Butterfly effect, or the theory that a Butterfly flapping can effect large scale weather patterns such as tornadoes and hurricanes even from hundreds of miles away. Chaos Theory is also applicable in systems other than weather, such as the stock market and physics. While these are very complex systems, there are chaotic mathematical systems represented by fractal images which this project aims to investigate. In such complex systems, the use of a supercomputer can be valuable in predicting results, so this project will use the supercomputer as well.

Purpose

The purpose of this project is to investigate Chaos Theory while applying advanced supercomputing algorithms using the Message Passing Interface (MPI). It is my intent through this project to learn about high performance computing as well as the highly complex field of physics and mathematics of chaos.



Progress

This quarter I made significant progress. I wrote a new rendering algorithm commonly known as the buddhabrot. This algorithm takes more time and processing power than the standard Mandelbrot set, so MPI will have a more substantial impact on the results. I also converted all of my other programs I had written for the second quarter, to MPI to utilize multiple processors. Thanks to Mr. Latimer and the people at Cray, the school supercomputer is now fully functional and I can begin to benchmark my results to analyze the performance benefits from using multiple processors.