

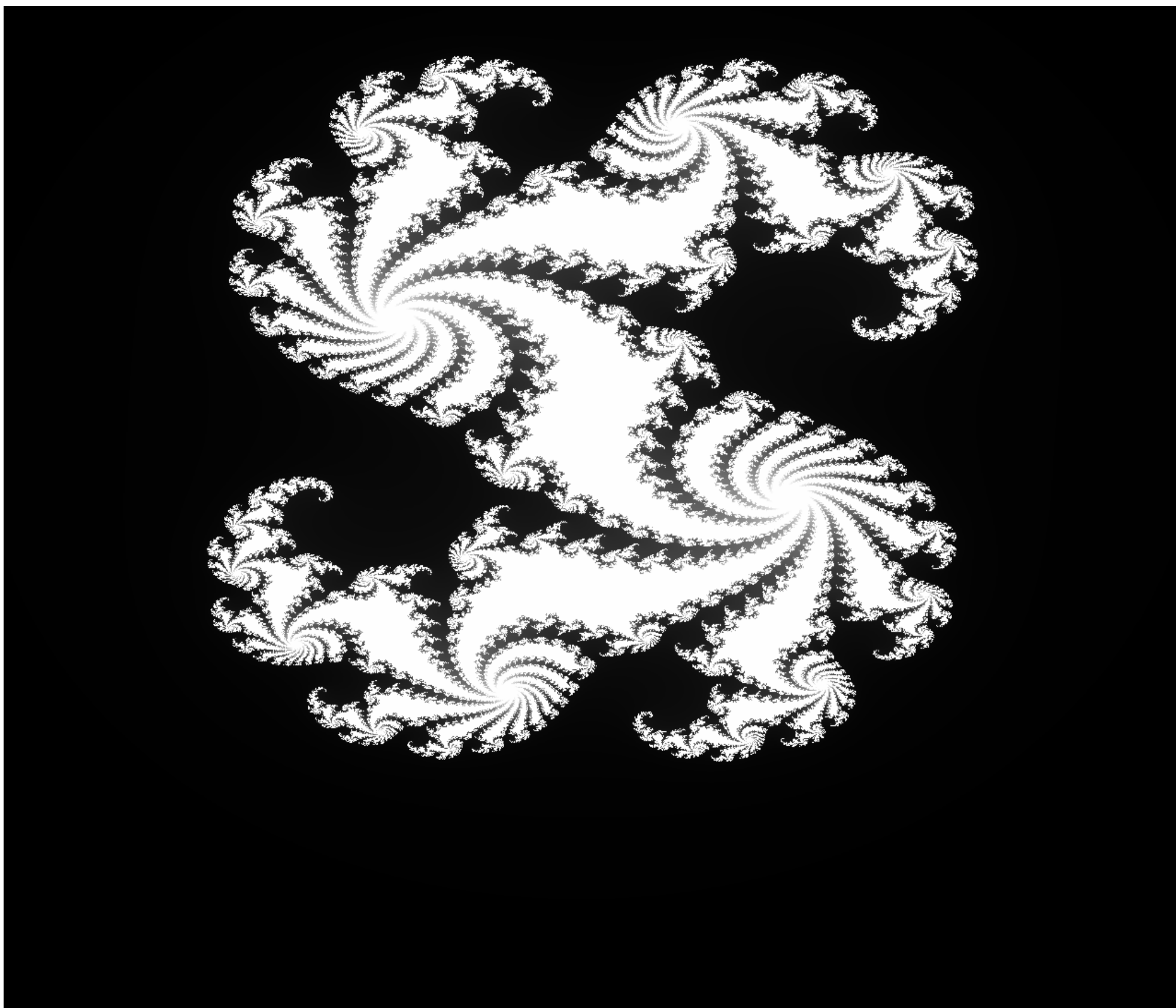
# An Investigation of Chaos Theory Using Supercomputing Techniques

Bryan Ward  
1/24/07

---

## 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). Through an analysis of more simple chaotic systems, I hope to learn about more sophisticated systems.

## Progress

While I have only been working on this project for a few weeks now I have been able to make good progress. I have successfully coded both the Mandelbrot and Julia set fractals in both C and Fortran to do a performance comparison between the languages. I have also created a Julia Set fractal video by stringing together a series of Julia set fractals with a given interval of the constant  $C$ . This in addition to an interactive Java interface I have written will help me to more thoroughly analyze my results.