ColAUMS Space

Newsletter of the AUMS | Issue 3, 2022

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Pub-crawl	-	26/08
AUMS Ball	-	16/09

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See us at our next event to sign up or use the link below!
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Another image from the JWST

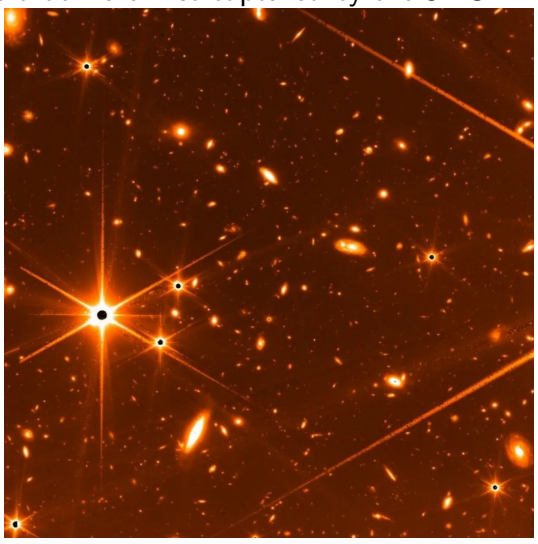
Introduction

Hi everyone and welcome back to Semester 2! I hope you all had a fantastic break and achieved the results you wanted. This semester is full-on fun and exciting AUMS events. We've already had our meet and greet in Week 2, Quiz Night in Week 3, and coming up our pub-crawl on Friday Week 5 and the AUMS Ball in Week 8. For more details about these events check our Facebook page close to the dates. In this edition of ColAUMS we have an article about the maths behind the James Webb Space Telescope as well as an article about Cellular Automation. I hope everyone has enjoyed the first few weeks back at Uni and I look forward to seeing you all at the events!

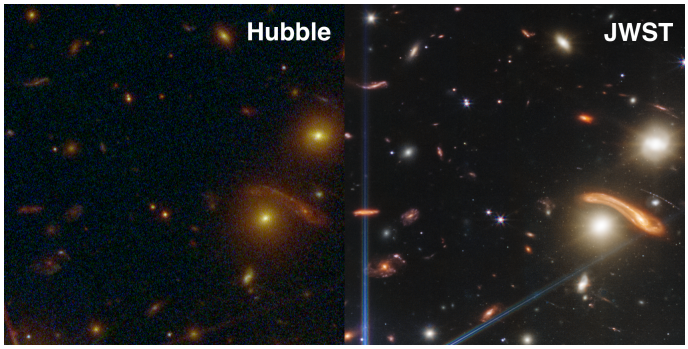
- *Nicholas Aplin, ColAUMS Editor*

The Maths Behind JWST

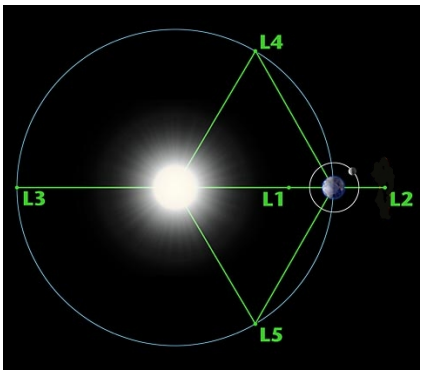
The James Webb Space Telescope (JWST) is the latest space telescope launched by NASA, which has recently shared some of its first images. It was launched on the 25 of December 2021 to capture higher quality images of objects that were first discovered by the Hubble space telescope. Below are some of the images that were first captured by the JWST:



One of the first images from the JWST



A comparison of the JWST and the Hubble Space Telescope The physical phenomenon that allows the JWST to stay steady in space to take these amazing images is called Lagrange points. These are points such that all the gravitation pulls of the Sun, Earth and Moon perfectly cancel out so that the JWST will remain stationary. Below is an image of the 5 Lagrange points between the Sun and Earth.



These points are classed as ether stable of unstable equilibria. Satellites in Stable equilibria will be pulled back to the Lagrange point if it drifts away slightly whereas for satellites in unstable equilibria, a small drift will compound over time and result in that satellite drifting away forever.

- Nicholas Aplin, ColAUMS Editor

Cellular Automation

A cellular automaton (CA) is a collection of cells arranged in a grid of specified shape, such that each cell changes state as a function of time, according to a defined set of rules driven by the states of neighbouring cells.

Typical characteristics of a CA are the following:

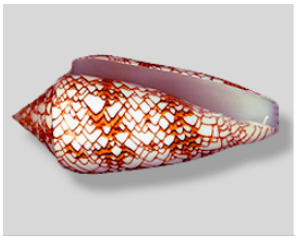
1. The cells in a CA reside on a grid which has a specified shape (square, triangle, hexagon, etc.) and exist in a finite number of dimensions.

2. Each cell on the grid has a state. While there are numerous finite possibilities of the state, the simplest state form is usually ON or OFF (or TRUE/FALSE or 1/0).

3. The cells adjacent to one cell constitute its neighbourhood. Cells in a neighbourhood affect each other, and each cell on the CA grid has a neighbourhood.

Based on predeterminant rules complex dynamical behaviour arises from these CA models that can be used to describe many natural phenomena. For example, one of the most famous CA is Conway's Game of Life which has only three deterministic rules but can create very intriguing patterns that deserves a google search. Or maybe even program it yourself!

Furthermore, CA models is capable of capturing the patterns in nature such as the patterns of seashells shown below



In fact, CA have been used to model various of biological behaviour from microbial growth to cancer research. In particular, applied mathematicians use these models to better understand the growth of biological cells and couple these with experimental data to predict biological behaviour. These models also have numerous applications in other fields of research such as ecology, physics, chemistry, and other sciences.

- Kai Li, AUMS Vice President