



Research project on JWST optical instrumentation

Context:

James Webb Space Telescope was scheduled for launch and deployment in 2012 but was finally launched in December 2021 and successfully delivered its first image in June 2022. As the largest optical telescope in space, its high resolution and sensitivity allow it to view objects too old, distant, or faint for the Hubble Space Telescope. This will enable investigations across many fields of astronomy and cosmology, such as observation of the first stars, the formation of the first galaxies, and detailed atmospheric characterization of potentially habitable exoplanets.

Project goals:

The Near Infrared Camera (NIRCam) instrument for NASA's James Webb Space Telescope (JWST) is one of the four science instruments installed into the Integrated Science Instrument Module (ISIM) on JWST intended to conduct scientific observations over a five-year mission lifetime.

It's a great opportunity to work on a cutting-edge optical system with direct applications of physical concepts seen in class. Fortunately, documentation on NIRCam instrument is publicly accessible and quite dense with several pointers to NIRCam subsystem papers.

Roadmap:

The first part of this research project will detail the core structure of the highly complex optical system embedded for IR imaging:

- A 3D model of the system will be provided.
- A simplified and interactive functional model will be designed to demonstrate the function of each component and their effect on the final image. It is the code production of the project, and it will most likely be written in Python.

A second part will focus on the overall anticipation of noise sources: random and systematic.