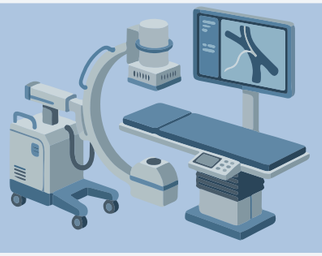


Peering into the Invisible

How Invisible Light Expands Human Vision

Presbyterian Ladies College, Fiona Yu, Intermediate Division



Introduction

According to Britannica, "Light is the electromagnetic radiation that can be detected by the human eye" (Britannica, 2026), but this explores only a portion of a much greater spectrum. Electromagnetic radiation deals with a wide range of light waves, which can be from 0.01nm (gamma rays) to a few meters (infrared radiation) . Within that, the visible range takes up only a few nanometers (NASA Science, 2023), but scientists since the early 1800s have developed technologies which allow us to peer into a more complex "invisible" world. My scientific poster aims to explore how scientists use different types of light waves to study space, improve medical technology and raise awareness for protection against high-energy light (UV).

Objectives

Space study before advanced space telescopes were invented was limited to inspection of celestial bodies within the Earth's atmosphere using optical telescopes. These were restricted by dust clouds and atmospheric absorption, which absorbed critical lightwaves from reaching ground-based telescopes (NASA - Imagine the Universe, 2014).

Medical imaging creates visual representations of the body's interior but relied on expensive, high-maintenance machinery (MRI and CT scanners) before uses of light across the full spectrum because visible light cannot penetrate skin tissue.

Where Invisible Light Comes In

Since discoveries in the 20th century, **space telescopes** such as the JWST use infrared light to capture star formations past dust clouds in seconds - which would have taken years for optical telescopes to piece together. X-ray observatories are now able to capture high-energy emissions from the world's most destructive environment, black holes (see figure 1).

Advancing medical imaging using light within the "near-infrared" window allows doctors to penetrate tissue and monitor blood flow without need for surgical intervention (see figure 2). This reduces costs in diagnosis and simplifies massive MRI machines to simple hand-held scans.

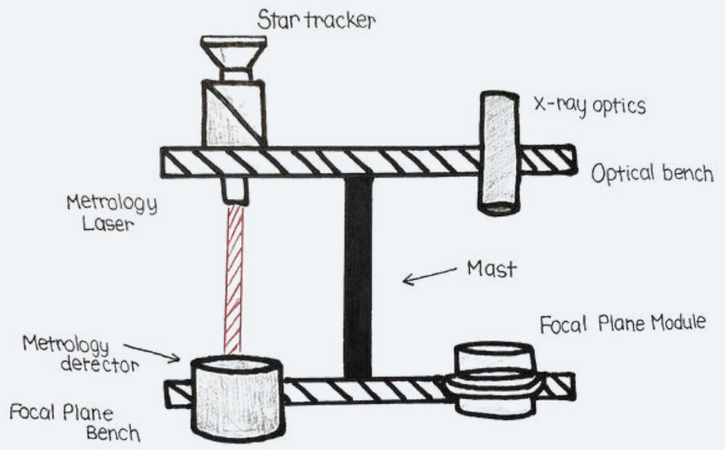


Figure 1: Simplified metrology system diagram used in X-ray telescopes

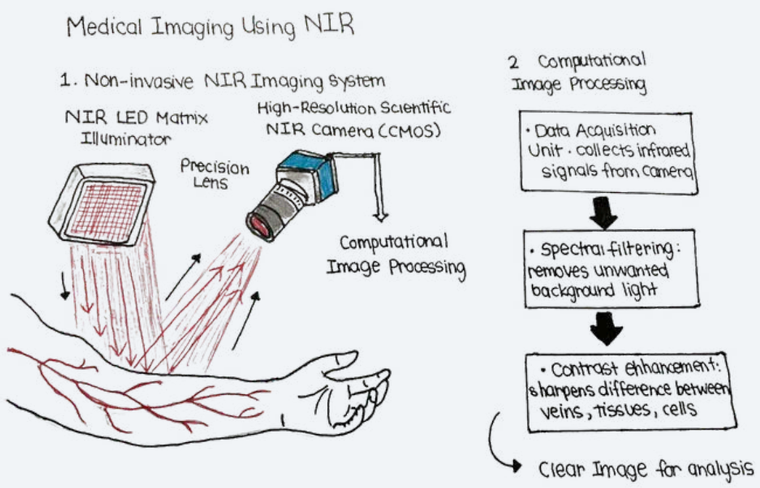


Figure 2: Diagram showing process of Medical Imaging using NIR

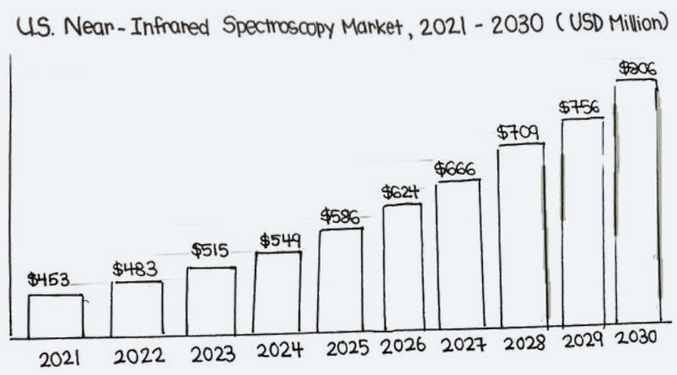


Figure 3: Near-infrared Imaging Market from 2021-2030, USD Million

Significance and Impact

Applying uses of invisible (ultraviolet/infrared) light to advance space discovery and medical imaging has led to significant breakthroughs with much greater efficiency.

Infrared telescopes can capture regions such as the Orion Nebula, past the thick clouds of cosmic dust. NASA estimates that it is where thousands of stars are formed, promoting research on star development. Also from NASA, the **JWST's infrared sensors** have detected gases like water vapour and carbon dioxide by measuring heat and chemical signs in the atmosphere of several exoplanets, boosting search for new habitable worlds.

CT scans have also been introduced in **medical imaging**, which combines multiple X-ray images to create detailed cross-sectional scans of the body in under 10 minutes. This reduces treatment delays in emergency diagnosis. There are also improvements in the near-infrared imaging (NRI) market, which foresees $800 million by 2030 (Grand View Research) as more surgeons adopt new fluorescence-guided systems using near-infrared light in surgeries (see figure 3).

In conclusion, we have entered a world where visible and invisible lights have met to create new opportunities, advancements and breakthroughs in areas of astronomy and healthcare. In reflection, **"We are seeing the universe in a way we never could with visible light alone."** (Dr Jane Rigby, NASA astrophysicist).

Acknowledgements and References

- NASA Science. (2023). Visible Light. https://science.nasa.gov/ems/09_visiblelight/
- Britannica. (2026). Light. https://www.britannica.com/science/light
- NASA - Imagine the Universe. (2013). Observatories Across the Electromagnetic Spectrum. https://imagine.gsfc.nasa.gov/science/toolbox/emspectrum_observatories1.html
- National Institute of Biomedical Imaging and Bioengineering. (n.d.). Magnetic Resonance Imaging (MRI). https://www.nibib.nih.gov/science-education/science-topics/magnetic-resonance-imaging-mri
- National Library of Medicine. (n.d.). Magnetic Resonance Imaging (MRI). https://pmc.ncbi.nlm.nih.gov/articles/PMC3595196/