



Encouragement Award

Science Writing Year 7-8

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Infrared Light - Its Past, Present and Future

The first things that may come to mind when we think of light are the rays from the sun on a day when the sky is clear, or soft glows from streetlights when the sun is shining elsewhere. However, those are both forms of visible light, which is only a miniscule part of the light that surrounds us.

Although it is not possible to perceive infrared light with human eyes, we are still able to observe it in the form of heat. Infrared light is on the electromagnetic spectrum like visible light, but it ventures past the point of what we see as red. (*'What is Infrared?'*, Cool Cosmos 2013). That means that the wavelengths are longer than the ones of the red end of the spectrum. The Economic Times of India defines wavelength by the distance between the troughs of a wave. In addition, the longer the wave, the lower the frequency will be. Light holds wavelengths of 0.4 to 0.7 micrometers, while infrared wavelengths start at 0.7 micrometers and continue to 1000 micrometers.

In the early stages of the 19th century, with a series of Sir William Herschel's experiments, infrared light was discovered. Herschel's findings can be best understood through the lab notes he left, which included data along with observations. However, it was a struggle to decipher those notes as they were mostly just data and deviations from the focus of the experiments. On March 27, 1800, a paper of Herschel's was read to the Royal Society, the oldest national scientific society in the world, in which he described warmth detected from a distance as 'radiant heat', as the term 'infrared' was not introduced into common scientific vocabulary until the late 1800s. The prefix of infrared, 'infra', is below in latin, but unfortunately, researchers have not been able to find who originally proposed the term. (Herschel and the Puzzle of Infrared, JACK R. WHITE).

Herschel's experiment consisted of separating sunlight using a prism and then positioning a thermometer at each individual colour. He observed that the thermometer showed the temperature rising, which was not surprising as it was acknowledged that sunlight carried warmth. The thermometer's temperature rising when Herschel placed it past the red point of the spectrum, where the sunlight was no longer visible, on the other hand, was a new discovery. Herschel had then found evidence of infrared radiation. (COSMOS, Infrared).

This discovery of Herschel's was just the beginning of infrared history, and resulted in various new technologies being developed. The first and arguably, the most significant invention in infrared's history, produced by Samuel P. Langley was the bolometer, a device used for detecting along with measuring microwave radiation and heat. A bolometer functions by utilising an element that is sensitive to temperature and the resistance of the particular element will change via the temperature. (Elprocus, What is a bolometer: Circuit and its working).

Langley's bolometer plays multiple roles that are applicable in a variety of situations. These include but are not limited to particle detectors, thermal cameras and forest fire detection. Particle detectors can be utilised when collisions occur to observe what particles were created

and their individual paths. If it is possible to be aware of what particles were created, their path and the energy they possess, it is then possible to recreate what happened in the crash and aids to prevent similar situations from happening once more. (Science and Technology Facilities Council, What is a Particle Detector?). Thermal cameras are instruments that take infrared energy and transform it into a visual image. The slightest differences in heat detected by a thermal camera, such as 0.01 degrees Celsius, can be displayed using different colour palettes or a range of grays. These cameras were initially created to be a major part of the military and surveillance but has now grown to be much more widely used to inspect insulation in buildings, firefighting and scientific research in general. (Teledyne Flir, How do Thermal Cameras Work?). Additionally, the bolometer was utilised when developing forest fire detection systems. Thermal imaging paired with sensitive infrared cameras and efficient software make it so that hot spots can be detected early and areas at risk of fires can be monitored closely. (Fire Protection Technologies, Thermal Imaging Detection). Particle detectors, thermal cameras and fire detection systems are all proof of the positive effect that the discovery of infrared energy and the development of infrared technology has had on the environment surrounding us in the people habituating it.

Even though infrared has come a remarkably long way since its discovery in the 1800s, it still has much potential to be developed into creations that will benefit the environment and its population further. Inventions such as infrared heating panels are relatively new in our modern society. Infrared heating panels produce infrared light and consequently provide warmth for the surrounding environment. These heating panels offer instant warmth, silent services compared to regular heating, and the indoor conditions are not altered like regular heating may alter them. Infrared heaters allow humidity in a room to remain a comfortable level and in addition, the amount of oxygen stays the same. However, infrared heating comes with its fair share of disadvantages, such as possible health risks and dehydration. (Green Garage, 14 Major Pros and Cons of Infrared Heaters).

Furthermore, the discovery of infrared radiation has resulted in skin screening being possible. In light of the current crisis the world is struggling with, the Coronavirus, it is vital that technology is available to detect symptoms of the virus people may possess without being aware. Businesses, schools and restaurants all utilise thermal screening to help keep their workers, students and the general population safe as without a proper test, it is best to use technology like thermal screening in place of them. Thermal screening used in this method is not new though, as in the past, it has been used for pandemics of SARS, swine flu and MERS. One thing that has changed considerably is that the demand for infrared technology has risen and Global Market Insights claim that by 2026, the market is expected to grow by 10 billion dollars. Due to the pandemic, infrared technology is now a market that is heavily in demand. The most notable issue with thermal screening is that not every victim of Covid displays symptoms through fevers or high temperatures. (CNBC).

To conclude, infrared energy, from its origins in the 1800s to thermal screening commonly used in the pandemic the world is facing, was and continues to be an essential discovery for the wellbeing of our surroundings and the people living in it. Langley's bolometer is an invention that

eventually led to the particle detector, thermal cameras, fire detection systems, thermal heaters and skin screen technology. Observing the trends in developments, I believe that the market for thermal technology will continue to grow due to the pandemic and that its development is vital.

[Word Count: 1155]

Referencing list:

Cool Cosmos, What is Infrared (2013)

https://coolcosmos.ipac.caltech.edu/page/what_is_infrared

The Economic Times, Definition of Wavelength (2021)

<https://economictimes.indiatimes.com/definition/wavelength>

Jack R. White, Herschel and the Puzzle of Infrared, American Scientist (2012)

<https://www.americanscientist.org/article/herschel-and-the-puzzle-of-infrared>

Cosmos, Infrared <https://astronomy.swin.edu.au/cosmos/i/Infrared>

Elprocus, What is a Bolometer: Circuit and its Working

<https://www.elprocus.com/what-is-a-bolometer-circuit-its-working/>,

Science and Technology Facilities Council, What is a Particle Detector? (2019)

<https://stfc.ukri.org/public-engagement/activities-for-schools/particle-physics-for-you/what-is-particle-physics/what-is-a-particle-detector/>

Teledyne Flir, How do Thermal Cameras Work?

<https://www.flir.com.au/discover/rd-science/how-do-thermal-cameras-work/>

Fire Protection Technologies, Thermal Imaging Detection

<https://www.fire-protection.com.au/product-menu/fire-detection/thermal-imaging-detection>

Brandon Miller, 14 Major Pros and Cons of Infrared Heaters, Green Garage (2019)

<https://greengarageblog.org/14-major-pros-and-cons-of-infrared-heaters>

Andrew Evers, Covid-19 has caused a spike in demand for infrared technology, but there are limitations, CNBC (2020)

<https://www.cnbc.com/2020/08/25/can-infrared-technology-help-stop-the-spread-of-covid-19.htm>

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