NARRATION: All electromagnetic radiation is light. Visible light is the only part of the spectrum you can see. For all your life, your eyes have relied on this one narrow band of EM radiation to gather information about your world.

Though our Sun’s visible light appears white, it is really the combined light of the individual rainbow colors, with wavelengths ranging from violet, at 380 nanometers, to red, at 700 nanometers. Before Isaac Newton’s famed experiment in 1665, people thought that a prism somehow colored the Sun’s white light as it bent and spread a Sun beam. Newton disproved this idea by using 2 prisms. To show that white light is made up of the bands of colored light, Newton used a second prism to show that the bands of colored light combined to make white light again.

Visible light contains important scientific clues that reveal hidden properties of objects throughout the universe. Minute gaps in energy at specific visible wavelengths can identify the physical and chemical composition of stellar and interstellar matter. Human eyes aren’t nearly sensitive enough to detect these faint peaks, but scientific instruments can.

Scientists can learn the composition of an atmosphere by considering how atmospheric particles scatter visible light. Earth’s atmosphere, for example, generally looks blue, because it contains particles of nitrogen and oxygen which are just the right size to scatter energy with the wavelength of blue light. When the Sun is low in the sky, however, light travels through more of the atmosphere and more blue light is scattered out of the beam of sunlight before it reaches your eyes. Only the longer red and yellow wavelengths are able to pass through, often creating breathtaking sunsets. When scientists look at the sky, they don’t just see blue; they see clues about the chemical composition of our atmosphere.

However, visible light reveals more than just composition. As objects grow hotter, they radiate energy with a shorter wavelength, changing color before our eyes. Watch a flame shift from yellow to blue as it is adjusted to burn hotter. In the same way, the color of stellar objects tells scientists much about their temperature. Our Sun produces more yellow light than any other color because of its surface temperature. If the Sun’s surface were cooler, say, 3 thousand degrees Celsius, it would look reddish, like the stars Antares and Betelgeuse. If the Sun were hotter, say, 12 thousand degrees Celsius, it would look blue, like the star Rigel.

Like all parts of the electromagnetic spectrum, visible light data can also help scientists study changes on Earth, such as assessing damage from a volcanic eruption. This NASA EO1 image combines both visible and infrared data to distinguish between snow and volcanic ash and to see vegetation more clearly. Since 1972, images from NASA’s Landsat satellite have combined visible and infrared data to allow scientists to study changes in cities, neighborhoods, forests, and farms over time.

Visible light images taken by NASA’s Mars landers have shown us what it would look like to stand on another planet. They have expanded our minds, our imagination, and our understanding.

NASA instruments can do more than passively sense radiation. They can also actively send out electromagnetic waves to map topography. The Mars Orbiting Laser Altimeter sends a laser pulse to the surface of the planet and sensors measure the amount of time it takes for this laser signal to return. The elapsed time allows the calculation of the distance from the satellite to the surface. As the spacecraft flies above hills, valleys, craters, and other surface features, the return time varies and provides a topographic map of the planet’s surface.

Back in Earth orbit, NASA’s ICESat mission uses the same technique to collect data about the elevation of the polar ice sheet to help monitor changes in the amount of water stored as ice on our planet. Laser altimeters can also make unique measurements of the heights of clouds, the top of the vegetation canopy of forests, and can see the distribution of aerosols from sources such as dust storms and forest fires.

Finally, visible light helps us to explore the far reaches of the universe that humans could not hope to reach physically. Using visible light, the Hubble Space Telescope has created countless images that spark our imagination, inflame our curiosity, and increase our understanding of the universe.