

THE POWER OF Light

Light reveals the world to us. Body and soul crave it. Light sets our biological clocks. It triggers in our brains the sensations of colour. Light feeds us, supplying the energy for plants to grow. It inspires us with special effects like rainbows and sunsets. Light gives us life-changing tools, from incandescent bulbs to lasers and fibre optics. Scientists don't fully understand what light is or what it can do. They just know that it will illuminate our future.

By Joel Achenbach
Photographs by Joe McNally

**Light permeates
our reality at
every scale of
existence. It's
an amazing tool,
a carrier of beauty,
a giver of life.**

THERE HAS BEEN LIGHT from the beginning. There will be light, feebly, at the end. In all its forms visible and invisible it saturates the universe. Light is more than a little bit inscrutable. Modern physics has sliced the stuff of nature into ever smaller and more exotic constituents, but light won't reduce. Light is light, pure, but not simple. No one is exactly sure how to describe it. A wave? A particle? Yes, the scientists say. Both.

It is a measure of light's importance in our daily lives that we hardly pay any attention to it. Light is almost like air. Its a given. A human would no more linger over the concept of light than a fish would ponder the notion of water.

There are exceptions, certain moments of sudden appreciation when a particular manifestation of light, a transitory glory, appears a rainbow, a sunset, a pulse of heat lightning in a dark sky, the shimmering surface of the sea at twilight, the dappled light in a forest, the little red dot from a professor's laser pointer. Stained glass in a church, backlit by a bright sky. The flicker of a candle, flooding a room with romance. The flashlight searching for the circuit breakers after a power outage.

Usually, though, we don't see light, we merely see *with* it. You can't appreciate the beauty of a rose if you ponder that the colour red is just the brain's interpretation of a specific wavelength of light with crests that are roughly 700 nanometers apart. A theatrical lighting director told me that she's doing her job best when no one notices the lights at all. Her goal is to create an atmosphere, a mood not to show off the fancy new dichroic filters that create colours of startling intensity.

As someone whose understanding of light pretty much began and ended with the flipping of switches, I worried that a story about light would be rather ethereal and esoteric. Surely there wouldn't be anything resembling breaking news on the light beat. Wrong!

Try an Internet search under the keyword "photonics". A photon is what you call light when it's behaving like a subatomic particle. Photons, it turns out, are a hot commodity. They are replacing electrons we know them from grade school as the negatively charged particles that orbit the nuclei of atoms as the favourite tool of modern industry for transmitting information. Light is now used for everything from laser eye surgery to telephone technology. The potential military applications of light are straight out of science fiction, and within a decade light may be the preferred weapon for zapping hostile missiles out of the sky. Light could even become the pre-eminent power source for long-distance space travel. The spaceship would have an ultra thin sail to catch the wind of light beamed from an Earth-based laser. In theory such a craft could accelerate to a sizable fraction of the speed of light without carrying fuel.

The more you look at the topic, the more you realize that our lives are built around light, that our daily existence is continuously shaped and made vivid by that ambiguous stuff that dates from the beginning of time. From our technology to our spirituality, we are creatures of light.

One question won't seem to go away: What *is* light, exactly? I got a piece of the answer from the world's largest laser, the National Ignition Facility. NIF is under construction at the Lawrence Livermore National Laboratory about an hour east of San Francisco. The laser is actually 192 lasers in collusion or perhaps one should say collision. The 192 individual beams of light, grouped in bundles of four, will travel the length of a hulking building 700 feet long and 400 feet wide. Entering a switch-yard of mirrors, each bundle will ricochet and shoot through one of 48 portals of the target chamber. The chamber is the star attraction of the facility. Its 30 feet in diameter, weighing a million pounds. The portals give it a dimpled surface that brings to mind an enormous golf ball from outer space.