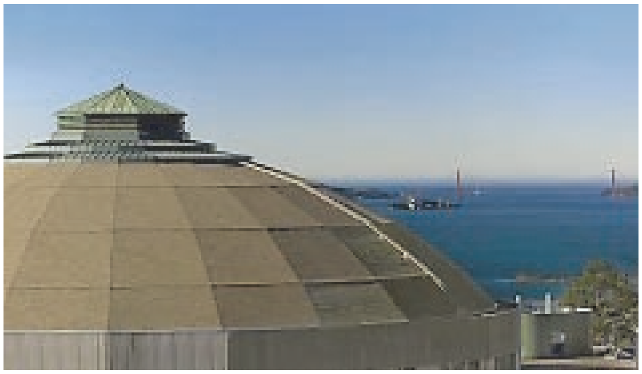
Advanced Light Source

QUICK FACTS

The ALS Site



The original building, situated in the East Bay Hills overlooking San Francisco Bay, was completed in 1942. Designed by Arthur Brown Jr. (designer of Coit Tower in San Francisco), it was built to house Berkeley Lab's namesake E.O. Lawrence's 184-inch cyclotron, an advanced version of the first cyclotron he invented and for which he received the Nobel Prize in Physics in 1939. Today, the expanded building houses the Advanced Light Source (ALS), a third-generation synchrotron and national user facility that attracts scientists from around the world.

Total ALS Staff: 175 **Visiting Researchers/Users:** 1900+ per year and growing

Funding Agency: U.S. Department of Energy, Office of Basic Energy Sciences

ALS Construction Costs: $99.5 million
Construction Started: 1987
Construction Completed: March, 1993
Facility Dedicated: October 22, 1993

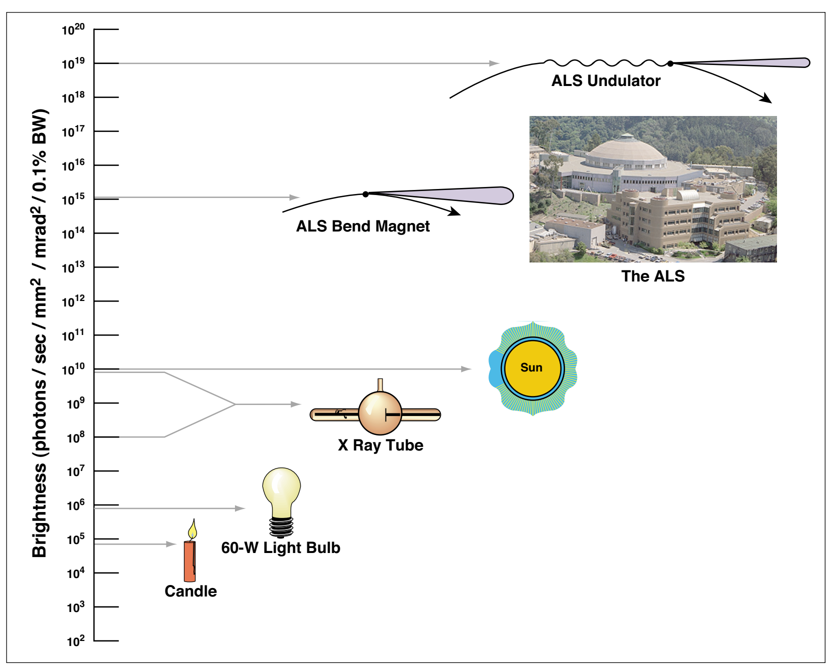
How the ALS Works

Electrons travelling nearly the speed of light, when forced into a circular path by magnets, emit bright ultraviolet and x-ray light that is directed down beamlines to experiment endstations.

Nature of Particles in the Storage Ring: Electrons with a nominal energy of 1.9 GeV
Size of Electron Beam: ~0.20 mm × 0.02 mm (about the width of a human hair)
Operating Beamlines: 35 plus the Beam Test Facility
Possible Beamlines: ~50

How Bright Is It?

The Advanced Light Source (ALS) produces light in the x-ray region of the electromagnetic spectrum that is one billion times brighter than the sun. This extraordinary tool offers unprecedented opportunities for state-of-the-art research in materials science, biology, chemistry, physics, and the environmental sciences. Ongoing research topics include the electronic structure of matter, semiconductors, crystallography, polymers, malaria, ozone photochemistry, and optics testing.



For additional information about the ALS, visit our Web page at: **www-als.lbl.gov**

Or explore the world of matter with us at: **www.lbl.gov/MicroWorlds/**

Or contact Berkeley Lab's Office of Public Affairs: **510·486·5771**

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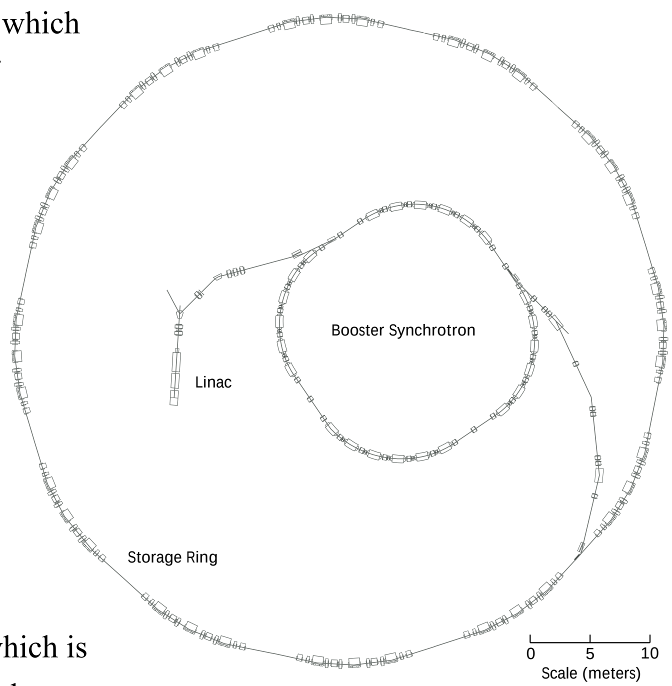
New Tools Make New Investigations Possible

How and what we "see" depends on the tools we use—be it a telescope, a light microscope, an x-ray machine, or even our eyes. What we see with our eyes is limited to the light which illuminates an object—and how our eyes perceive what they are seeing. Our eyes can only interpret light in the visible region of the electromagnetic spectrum. But what if you want to peer inside a living cell and look at the molecules which form a cell wall? Or probe the surface of a silicon chip—atom by atom? The Advanced Light Source (ALS) produces light in the wavelengths required for "sight" into the world of molecules and atoms. How this unique light is produced and how it is used is a feat of both innovative engineering and pioneering science.

The Advanced Light Source is a synchrotron which produces light in the form of bright beams of x rays. It does this by generating a hair-thin beam of electrons and accelerating them in a linear accelerator, and then in a booster ring to nearly the speed of light (that is 299,792,000 meters/sec—at that speed you could go around the world almost 7.5 times in a second). The electrons are then "stored" in a 200-meter ring guided by a series of magnets which force them into a curved trajectory. As they travel around the storage ring, the electrons emit synchrotron radiation—energy in the form of photons—which is directed by specialized optics down 12-meter long beamlines to experiment endstations.



The wavelengths of the synchrotron light span the electromagnetic spectrum from infrared to x rays and have just the right size and energy range for examining the atomic and electronic structure of matter. These two kinds of structure determine nearly all the commonly observed properties of matter, such as strength, chemical reactivity, thermal and electrical conductivity, and magnetism. The ability to probe and understand these properties allows us to design materials with particular properties, or understand biological processes inscrutable to visible light.