ing complex experimental regimens to be undertaken within reasonable time and cost. Also, because there are so many light rays (photons) impinging on a surface, it makes certain rare experimental events occur more frequently. This increases the strength of the resulting signal and allows observation of events not possible before, given the so-called "noise" levels and sensitivity limits of available instruments.

Third, the light beam is well behaved. Because it can be narrowly focused into a beam diameter hundreds of times smaller than a pinhole, it can eliminate many experimental distractions from light reflected off of areas not part of the particular point of interest. The light beam is also nearly "coherent," meaning that most of the waves in the beam are similar in length and propagate as cohorts, all moving in step. This enhances the predictability and usefulness of the light, particularly in experiments involving interactions with matter that occur only at precise wavelengths.

Finally, the light can be turned on and off with blinding speed, in less than one-billionth of a second, giving the experimentalist extraordinary control. Repetition of pulses, if desired, can be as frequent as a million times per second.

The fact that all these properties are found in one light source makes it a remarkably versatile tool. Once dismissed by the inventors of electron storage rings as a nuisance, synchrotron radiation is now widely regarded as a unique and highly valued scientific and technological resource.

The story of its emergence is one of vision and leadership on the part of many dedicated individuals, institutions, and agencies. Key agencies in the early development of synchrotron radiation included the National Science Foundation, the Department of Commerce's National Institute of Science and Technology (formerly the National Bureau of Standards), and the Department of Energy's High Energy Physics Program.

In the 1970's, however, it was Basic Energy Sciences which took the lead. The leadership of this program sponsored the major programmatic initiatives, guided the design of the facilities, and funded the substantial costs of construction and operation of the Nation's top synchrotron light sources.

This was no small accomplishment. The machines that produce synchrotron radiation are large and technically complex. In many respects, they resemble high energy physics particle accelerators, requiring state-of-the-art vacuum systems, powerful magnets at every step along the way, and sophisticated controls. A completed ring can be hundreds of feet in diameter. The so-called third-generation machines now being built range in cost from $100 to $500 million, depending upon their intended functions.

Moreover, decades of tradition within certain scientific communities had held that synchrotron radiation was, at best, marginally useful to a few and, at worst, a regrettable loss of energy detracting from other experimental objectives. In the beginning, access to synchrotron radiation was best obtained when no one else wanted to use the accelerators for other experiments.

Basic Energy Sciences researchers, however, were well positioned to appreciate the importance of synchrotron radiation. The program had long supported materials science research, which requires the probing of atomic relationships in solids—an ideal application for synchrotron radiation.

In the early 1970's, Basic Energy Sciences helped sponsor a watershed study conducted under the auspices of the National Academy of Sciences. This study critically assessed the Nation's need for facilities dedicated to synchrotron radiation. The resulting report, published in 1976, outlined a series of uses of synchrotron radiation, all relevant to urgent national priorities.

The Academy's report recommended both the construction of new and dedicated facilities and the upgrading of existing and shared facilities. It specified the capabilities required and noted that demand for such capabilities was growing and would soon outstrip all available assets.

Basic Energy Sciences researchers took up the challenge, invited the scientific community to refine an earlier design proposed by Brookhaven National Laboratory, and nurtured this design and others for upgrades into a broad set of programmatic initiatives for Presidential and Congressional consideration. In Fiscal Year 1979, a new facility was funded for construction. It was named the National Synchrotron Light Source and is sited at