

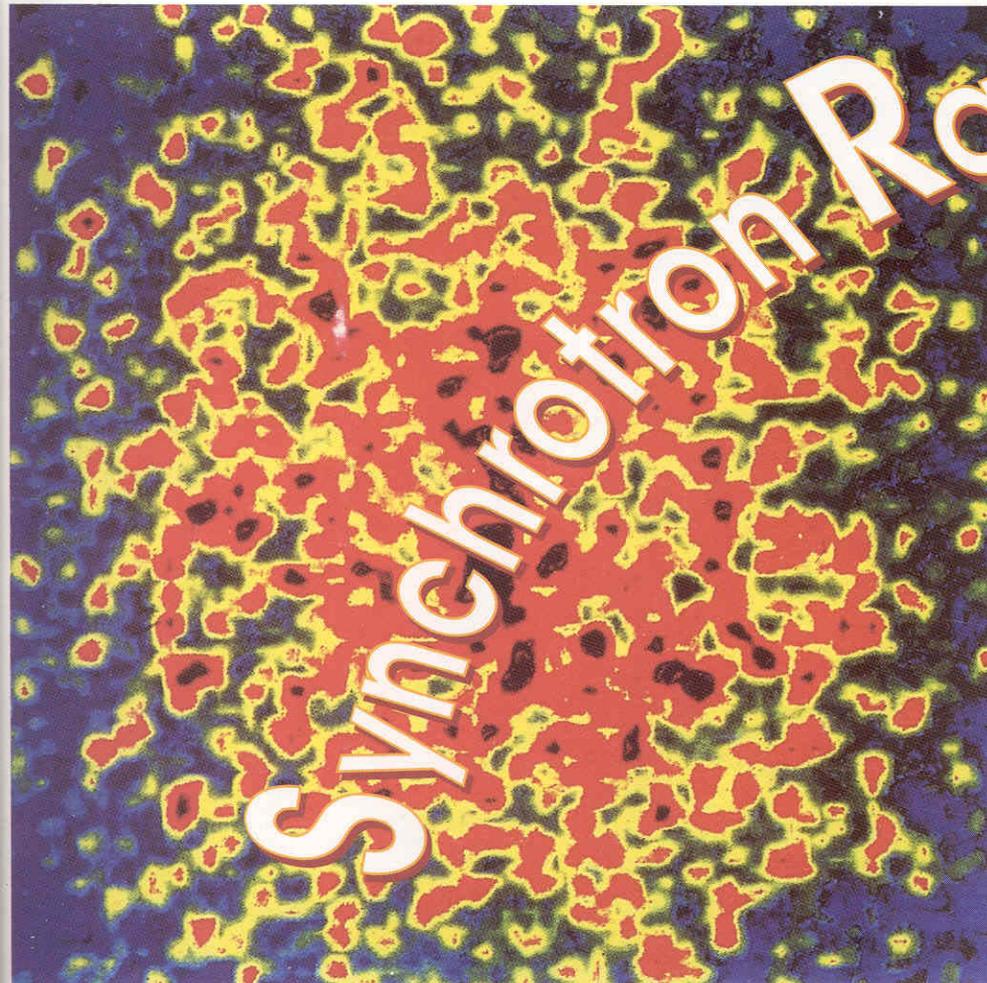
The
Forum



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Synchrotron Radiation: Israel's Turn to Shine?

When forced to change their direction, as in a ring-like particle accelerator (synchrotron), rapidly moving electrons emit a concentrated beam of X-rays in their forward direction. This beam resembles a rotating lighthouse searchlight in more ways than one, since synchrotron radiation is now routinely used to illuminate a wide variety of problems in materials science, polymer chemistry, biology, medicine and many other fields.

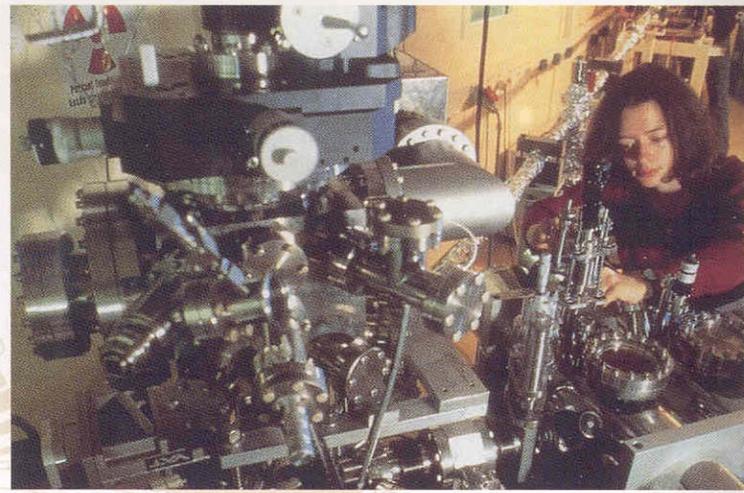
For example, the high intensity, collimation, focusability and brilliance of the beam permit capturing the X-ray diffraction patterns, and hence the molecular structure, of ultra-small or transient samples. This is particularly important in biology where many natural chemicals and their variants (mutants) can only be obtained in very small amounts, or in geophysical studies in high-pressure diamond anvil cells, where small samples are subjected to pressures normally found only deep within the earth. Small beam and sample sizes also allow better resolution when examining such samples as muscle fibers or viruses. Needless to say, synchrotron radiation's broad spectral range, stability, tunable energy, intensity and other good properties make it an exceptional tool for physicists studying inelastic scattering, nuclear scattering, magnetism, surface phenomena and X-ray optics.

Synchrotrons are, however, very "Big Science." The third-generation machines recently built in Europe (ESRF), the U.S. (APS) and Japan (Spring-8) can cost hundreds of millions of dollars to build and, in the case of the ESRF, about \$90 million a year to operate. This being the case, every available space on the gigantic ESRF synchrotron ring (see diagram on next page) is occupied by 30 public beam lines, 12 beam lines reserved for ESRF members and other experimental facilities. The ESRF received over 1000 proposals for experiments and over 13,000 requests for time slots during its first 16 months of public operation (September 1994-December 1995).

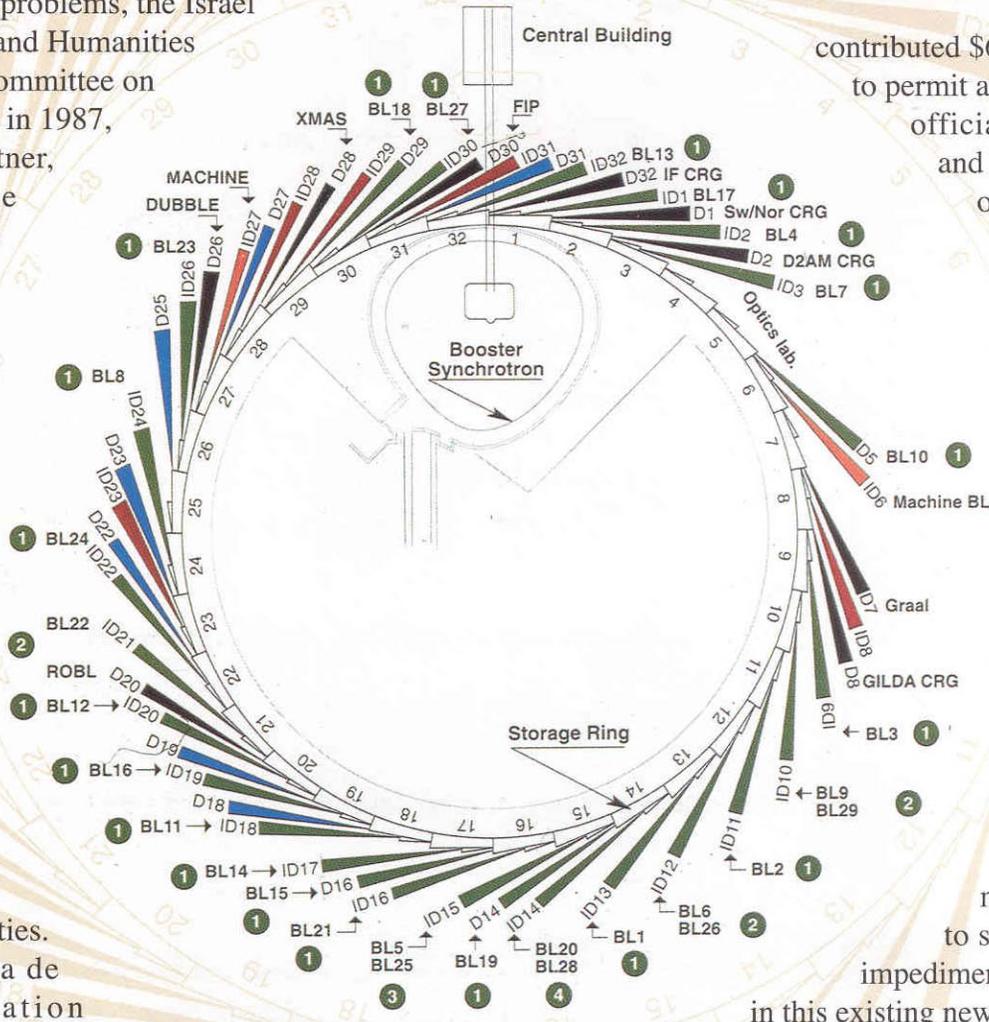
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Synchrotron Radiation Cont.

How does Israel fit into this exciting new frontier? Although 25 teams of Israeli scientists already use synchrotron radiation in their research, Israel is not yet a member of any such facility. That means that Israeli scientists must "tag along" as part of foreign research teams or compete on an individual basis for over-subscribed public beam lines. This makes it difficult for them to implement their own new experimental ideas, puts them at a significant disadvantage compared to scientists from ESRF member countries, and encourages them to collaborate with foreign rather than Israeli counterparts.



Keenly aware of these problems, the Israel Academy of Sciences and Humanities formed an Advisory Committee on Synchrotron Radiation in 1987, headed by Prof. J. Jortner, then President of the Israel Academy and currently President of AFBRI. Based on the Committee's recommendations, the Israel Academy began to take a more active role in this area. In 1993 it organized a symposium on "Synchrotron Radiation Research", together with prominent members of the APS, and gave four travel grants to help Israeli investigators visit synchrotron facilities. In 1994 the Batsheva de Rothschild Foundation



contributed \$60,000 of catalytic funds to permit additional scientist travel, official site visits to the APS and ESRF and the formation of an international panel to help advise Israel on joining an appropriate facility. That year 12 scientists received \$2500 travel grants to promote their research.

The international panel's final report concluded that the scientific level of Israeli synchrotron radiation research is exceptionally high, but that Israeli scientists desperately need more and better access to such facilities. The main impediment to Israel's participation in this existing new area is strictly financial.



The large sums required for Israel's formal membership in a major international facility will require, and will probably receive, government funding. However, the individual research teams will still need considerable seed money (\$20,000-\$200,000 each) to build and maintain the specialized equipment required for their experiments.

Foundations interested in further *details on* how they can help Israel participate in, and benefit from, synchrotron radiation research may contact AFBRI for additional information (see masthead).