Insertion Devices

The focus on insertion devices for beamlines has shifted away from building many copies of a standard multi-purpose undulator towards providing devices that are customized to best meet the needs of the research being done on the particular beamline. Planar undulators with a variety of new period lengths have been designed, built, and installed. The period lengths were chosen in consultation with the beamline users to maximize the brilliance in the particular tuning range of interest. New undulators with either existing or new period lengths can be designed and built as needed.

Other characteristics of the undulators can also be adjusted to suit the needs of beamlines. Work is underway on a polarizing undulator for the IEX beamline. While variable polarization of the x-rays produced would be of interest to other beamlines, here it is chosen because of the absence, on beam axis, of photons with higher harmonic energies. The undulator for IEX may also be quasiperiodic and capable of producing linear polarization. The quasiperiodicity is sought here because, although it reduces the brilliance in the first harmonic, it shifts the higher harmonics in energy so they don't make it through the monochromator. The loss in higher-harmonic contamination and the resulting improvement in the experimental signal-to-noise ratio more than make up for the loss in brilliance. Other users have also expressed interest in undulators with reduced higher harmonics.

Work is also underway on a superconducting undulator. Some users are interested in high-energy photons and want high brilliance. This can be achieved with shorter period undulators, but as the period length gets short the achievable field strength on axis decreases, decreasing the tuning range of the undulator. A short-period superconducting undulator can produce a stronger magnetic field than a permanent-magnet undulator with the same period length, making the additional brilliance from a shorter period feasible. The superconducting undulator as presently designed will produce first-harmonic x-rays in the 20-25 keV range.

Longer straight sections that allow either longer or additional undulators are also a possibility. Additional in-line undulators allow the possibility of customizing one undulator for a particular purpose without losing the flexibility that is provided by another. Also, the sector can be canted, when a bend is imposed on the beam between undulators so that two separate x-ray beams result, one from each undulator. Two separate beamlines at a relative angle of ~1 mrad can then be built and operate separately in the same sector.

Other specialized undulators could be developed to meet particular user needs. Users with other requirements are invited to discuss their needs with the Magnetic Devices Group. Contact the MD group leader, Liz Moog, at moog@aps.anl.gov .