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Superconducting undulators for an enhanced production of x-rays at the light sources[1]

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Modern synchrotron light sources utilize a beam of electrons to generate high intensity x-rays when the electron beam passes through special magnets called undulators. An undulator is a magnet with a static periodic magnetic field alternating along the length of the device. The electrons in such fields exhibit oscillatory trajectories and radiate energy in the form of photons. The undulator is therefore one of the key components of a light source facility. Thus far, most undulators have been built using strong permanent magnets that are usually arranged in two periodic structures separated by a gap where the accelerator beam vacuum chamber is located. A superconducting undulator is an electromagnetic undulator that utilizes electrical coils wound with a superconducting wire. Due to the high-carrying capacity of superconductors, the magnetic field of an undulator is very high and exceeds the one of a permanent magnet undulator for a given period length and magnetic gap. As a result, higher photon fluxes can be generated, especially at high photon energies. Other configurations of the magnetic field can also be realized. Superconducting undulator technology has been developed and is currently in use at the Advanced Photon Source (APS) of Argonne National Laboratory. Design and performance of superconducting undulators built at the APS are described in the talk. The advantages of superconducting undulator technology for the light source community are also discussed.

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