Nuclear resonant scattering at future 3 GeV SKIF storage ring

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Until recently, 'photon hungry' hard x-ray synchrotron techniques remained barely feasible at moderate energy storage rings (2-3 GeV), so that nuclear resonant scattering (NRS), inelastic x-ray scattering (IXS) and x-ray Raman spectroscopy (XRS) were developing exclusively at high-energy facilities. However, achievements in design of high-field short-period undulators (superconducting and cryogenic – see review [1]) together with significant improvement of x-ray beam quality at 4th generation storage rings have finally changed this situation (Fig. 1).

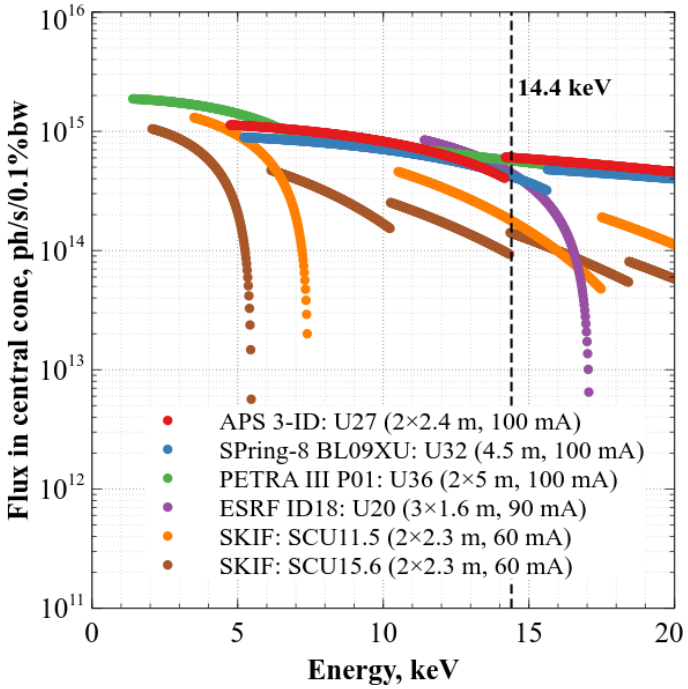

Figure 1. *Central cone flux of undulators used for ^{57}Fe NRS at high-energy storage rings compared with that of superconducting undulators of future 3 GeV SKIF facility*

SKIF (Russian acronym for 'Siberian circular photon source') is a 4th generation 3 GeV machine with perimeter of 476 m and emittance of ~75 pm·rad being currently built near Novosibirsk (Russia). A huge interest of national scientific community to NRS techniques at the energy of ^{57}Fe isotope stimulated us to include a fixed energy (14.4 keV) NRS end-station in the list of 'first stage' beamlines to be commissioned in 2024. The advantage of short-period superconducting undulators developed by Budker Institute of Nuclear Physics [2] together with low emittance of x-ray beam, which perfectly fits apertures of x-ray optics and acceptance of high-resolution monochromators, promise to achieve ~10^{10} ph/s in a submicron spot at ~2 meV bandwidth. Implementation of ultra-high resolution spectrographic monochromator [3] and synchrotron Mößbauer source [4] is also planned for future development of the end-station.

References

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