BL12XU
NSRRC ID

1. Overview

BL12XU has an undulator light source and two branches of the main line and a side line (Fig.1). The main line has been fully operational since 2001, and inelastic x-ray scattering is the major technique to be utilzed. The sideline is designed for hard-x-ray photoemission spectroscopy. A high resolution monochromator and a focusing mirror system were installed in 2008. An end station is currently being commissioned at the time of preparation. The layout of the whole beamline is shown in Fig.1.

2. Main line instrumentation : Diamond phase retarder

Horizontally polarized x-rays, typically emitted by synchrotron radiation, leads to a problem for the so-called horizontal arm spectrometer. The intensity is substantially suppressed at the scattering angle near 90° , corresponding to the momentum transfer of ~ 7 A^{-1} for 10keV x-rays, based on the polarization factor for Thomson scattering. In 2008, to minimize this problem, we installed a diamond phase retarder converting the polarization from horizontal to vertical. A 0.5mm thick diamond was tested. Fig.2 shows the degree of the linear polarization (P_L) of x-rays after the diamond as a function of the angular offset from the Bragg condition of the [220] reflection. The P_L of 0.85 was obtained at 12.7'' offset. The transmission from the diamond was 66% for 9.887keV x-rays.

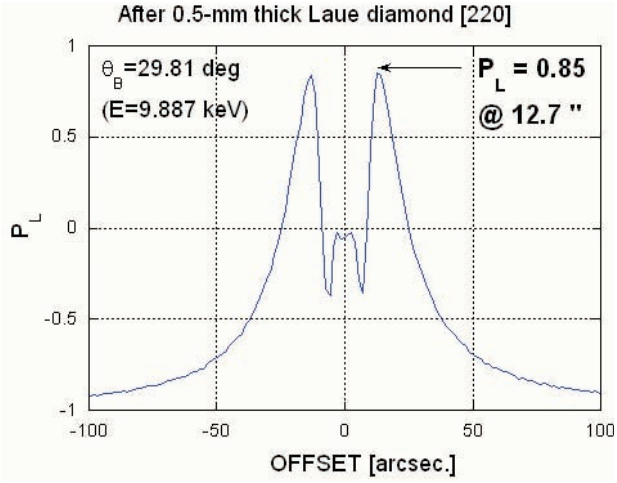

Fig.2 Stokes parameter for the linear polarization (PL) as a function of the offset from the diamond 220 reflection: The P_L of 0.85 was obtained at an offset of 12.7 arcseconds.

3. Main line experiments : High pressure / high temperature studies

The main line is equipped with Kirkpatrick-Baez-type mirrors (KB mirrors) producing a beam spot of ~ 20μm×20μm at the sample position, which is utilized for inelastic scattering and emission spectroscopy under high pressure. Pressure-induced transitions of the spin / electronic structure in iron compounds existing in the earth interior, a multiferroic material including manganese, or valence fluctuation systems such as Sm, Ce compounds were observed. Furthermore, the electronic structure in solid CO_2 under high pressure was also studied. The electronic structure in the liquid silicon above the melting point was studied by a levitation (floating) furnace. A remarkable difference in the inelastic scattering spectra between the solid state and the liquid state of silicon was observed.

4. Side line

In 2008, a high resolution monochromator and a KB mirror were installed (Fig.3). The single bounce diamond 111 reflection from the diamond monochromator (DM) introduces x-rays of 6 – 10keV to the experimental stations. The energy width can be

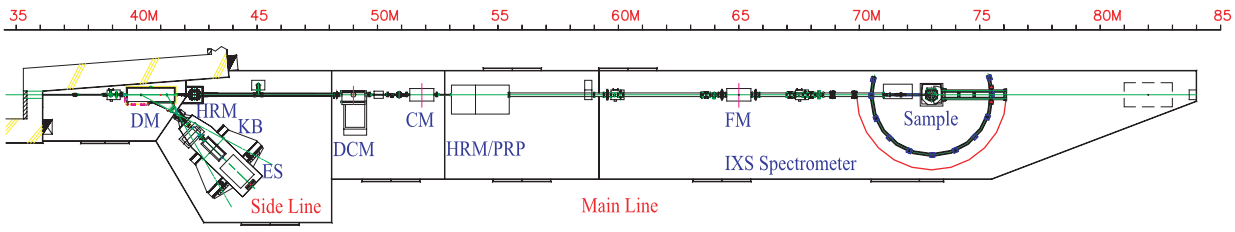

Fig.1 Schematic diagram (top view) of the BL12XU: DCM a double crystal monochromator for the main line, CM a collimating mirror, HRM a high resolution (channel cut) monochromator, PRP a phase retarding plate, FM a focusing mirror, and IXS an inelastic X-ray scattering spectrometer. For the side line DM is a diamond monochromator, HRM a high resolution (channel cut) monochromator, KB a Kirkpatrick-Baez X-ray focusing（mirrors） system; ES stands for the HAXPES end station.

reduced by a Si 333, 444, or 555 high resolution monochromator (HRM) and then the beam is focused by a KB mirror onto a sample. The focusing properties were tested by a CCD camera. A focus of 50μm (H) by 60μm (V) was obtained at the sample position without going through the HRM at 8keV. A sample chamber and a photoelectron analyzer will be installed in 2009. Several test experiments will be also performed.

Fig.3 Rotation platform mounting the high resolution monochromator and the KB mirror of the side line.

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