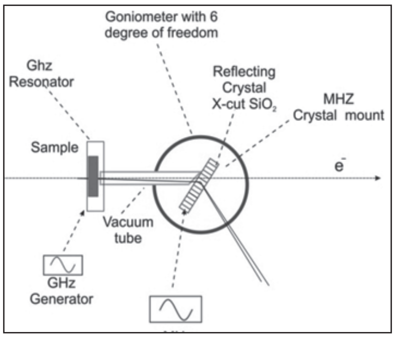
In the present work details of experimental investigations of X-ray transition radiation from the periodical permittivity structure are discussed. It is shown the possibility of Creation of a new generation of coherent x-ray sources according the scheme presented in the Figure below.

This phenomenon is observed for electrons of 20 MeV energy. For the electrons source we used the LEA-50 linac of the Yerevan Physics Institute [2]. The beam parameters are: current of the electron beam is 0.1 mcA, the energy resolution is $\pm$30 KeV, the vertical aperture is 0.0005 angular radian, the horizontal aperture is 0.01 angular radian. As a sample of investigations amorphous quartz with different thickness was taken. The acoustic field in the sample was excited by a specially designed system of high Q resonators. The emitted transition radiation and electron beam passes trough vacuum tube. For separation of the produced transition radiation from electron beam, additionally X-cut quartz crystal was placed after the amorphous quartz sample. The crystal was placed in the specially designed MHz mount and has satisfied full pumping condition for transition radiation [3-4]. The separated transition radiation passes trough vacuum tube and can be used as a coherent x-ray source.

The detailed analysis of experimental data shows that the peak of intensity depends on amorphous quartz purity, frequency and amplitude of the excited hyper frequency acoustic fields.

Results of investigation shows:

- The intensity of radiation may be varied by changing the value of hyper frequency electromagnetic field amplitude.
- The registered value of ratio N_γ/N_e is very large from expected and depends on target quality.
- The intensity of the radiation depends of $\Delta\omega_s$ ()i.e. boundary layers of plots by $\Delta\omega_s$.
- The analysis of numerous experiments results shows that the ratio value varies in the range > 1.
- For the targets of different summary thickness the intensity has no changes, i.e. only last layers have contributing in intensity.



According to the developed theory [1] the estimation of measured parameters has been in good agreement.

Let us note also that as a source of monochromatic x-ray radiation it can be used PXR when the crystal is excited by acoustic field.

[1] A.R. Mkrtchyan et al. Preprint ASA SSR, IAPP, Yerevan **1987**. [2] A.R. Mkrtchyan et al. Nanotechnologies in the area of physics, chemistry and biotechnology, Fifth ISTC SAC, Seminar. St. Petersburg, Russia, **2002**, 202-*204*. [3] A.R. Mkrtchyan et al. Письма в ЖТФ. **1983**, *9, 19*,1181-1184. [4] A. R. Mkrtchyan et al. *Proceedings the 51st Workshop of the INFN,* Channeling **2008**, 25- 1, Erice, Italy 306-308.

Keywords: transition, radiation, X-ray

MS07.P03

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Pair of canted undulator MX beamlines proposed for NSLS-II

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We describe a concept for x-ray optics to feed a pair of macromolecular crystallography (MX) beamlines which view canted undulator radiation sources in the same storage ring straight section. This has been proposed for the National Synchrotron Light Source –II (NSLS-II) and can be deployed at other low-emittance third-generation synchrotron radiation sources where canted undulators are permitted.

The concept adopts the beam-separation principles employed at the 23-ID (GM/CA-CAT) beamlines at the Advanced Photon Source, wherein tandem horizontally-deflecting mirrors separate one undulator beam from the other, following a double-crystal monochromator. The scheme described here would deliver the two tunable monochromatic undulator beams to separate endstations that address different and somewhat complementary purposes, with further beam conditioning imposed as required. A downstream microfocusing beamline would employ dual stage focusing for work at the micron scale and, unique to this design, switch to single stage focusing for larger beams. By contrast, the upstream beamline would only employ single stage focusing with variable focal length.

The final x-ray hutch in the downstream position would be relatively long (>~15 m), designed to accommodate a flexible secondary microfocusing optics system. This would include an adjustable secondary source aperture toward the upstream end of the hutch, and then microfocusing mirrors or lenses positioned just before the focus point at the experiment. When one requires the minimum beam size (~1 µm or less), two-stage horizontal focusing can be pursued by adjusting the curved figure of one of the upstream horizontally-deflecting mirrors to focus the beam at the secondary source aperture. The subsequent microfocusing optics would then re-focus the beam diverging from there. When a larger beam size (10-20 µm or greater instead of 1 µm) having less horizontal divergence (0.1 µrad instead of 1 µrad) is preferred, the microfocusing optics stage can be bypassed and the focal length of the upstream mirror can be adjusted accordingly.

A challenge that will be addressed in this beamline will be the manipulation of samples to take advantage of a 1 µm beam.

The other beamline, located upstream and with a somewhat shorter x-ray hutch (<~10 m), would contain a more conventional beam focusing optics system (demagnifying Kirkpatrick-Baez [K-B] mirror system) that would be permanently deployed. To employ the beam effectively, even with space restrictions in this experimental hutch owed to the presence of a beam tube passing through it to deliver a beam to the downstream beamline, we plan that the operation of this beamline will be highly automated with a minimum of manual access needed.

On this beamline, it is intended that the K-B mirrors can rapidly adjust their focal lengths to tailor the beam properties according to experimental requirements.

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Keywords: synchrotron_radiation_crystallography, synchrotron_radiation_optics, synchrotron_radiation_sources

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Multilayer optics for novel sources In X-ray analytics

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In this contribution, we will be providing an insight into current developments of multilayer optics for X-ray analytics in the lab and at synchrotrons. We explain the manufacturing process, summarize the different types of optics and give some examples of typical applications which benefit from the new possibilities, especially in combination with modern microfocus X-ray sources, novel metal-jet anode X-ray sources, mini-synchrotrons, beamlines and FELs.

The optics consist of bent substrates with shape tolerances below 100nm. By using sputtering technology we deposit multilayers upon these substrates with several hundreds of layer pairs and single layer thicknesses in the nanometer range. To ensure high-quality X-ray optics we fabricate the multilayers with lateral thickness gradients within ± 1% deviation of the ideal shape. We use optical profilometry in order to characterize the shape and X-ray reflectometry for the characterization of the multilayer thickness distribution both laterally and as in-depth. The microstructure is investigated by transmission electron microscopy.

Modern deposition technology allows for the reproducible production of high quality multilayer mirrors with smaller d-spacing. Thus, in combination with the latest generation of microfocus sealed tubes it is possible to provide new high-performance X-ray sources for shorter wavelengths. We will be presenting selected results on the use of our new air-cooled high-brilliance X-ray source IμS for Mo-Kα and Ag-Kα radiation in small molecule and high-pressure crystallography.

For home-lab sources our so-called Montel Optics focus or collimate the beam in 2D with a very high flux density and an adequate divergence directly at the sample position. However, synchrotrons need a higher quality of the shaped substrates. We designed and produced first Montel Optics of the third generation especially for an analyzer system at inelastic scattering beamlines.

Furthermore, we developed special multi-stripe optics for Double Crystal Multilayer Monochromators (DCMM) which are used at tomography beamlines in a wide range of photon energies (10-45keV).

In special mini-synchrotrons our longest multilayers of 40 cm in length are used. We will be showing first results.

In addition we will be presenting our total reflection optics for which we developed a large variety of ceramic and metallic layers on large substrates with a length of up to 150cm.

Keywords: X-ray optics, multilayer, source

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The new in situ screening facility at the MX-beamlines BL14.1 at BESSY II of the Helmholtz-Zentrum Berlin (HZB)

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In spite of large scale automation and an on-going miniaturisation process in high-throughput protein crystallisation, human efforts are required to pick individual crystalline specimens from 96-well crystallization plates and to characterize them. In addition, not optimal cryogenic stabilization solutions often mask the diffraction properties of macromolecular crystals. An alternative to this conventional approach is to expose macromolecular crystals or possible crystalline material grown in crystallisation plates directly in the X-ray beam [1]. We present the implementation of an *in situ* crystal screening platform [2] using the CATS sample changer and a MD2 microdiffractometer at the HZB-MX-beamline 14.1 [3].

The hardware implementation consists of a six-axis robotic arm and a dedicated tool for gripping crystallisation plates. This mode of operation is alternative to the normally used transfer of cryo-cooled samples. Every object within the plate can be precisely positioned in front of the X-ray beam. The robot arm acts as the omega-rotation axis during diffraction data collection.

Different proteins were subjected to standard sparse-matrix crystallisation screens in three different plate types and exposed in the beam using the robot. The results show an unambiguous identification of crystalline and non-crystalline objects. The diffraction images were successfully auto-indexed and important metrics of the crystal system could be determined. Furthermore, in some cases diffraction data sets could be collected to a high completeness.

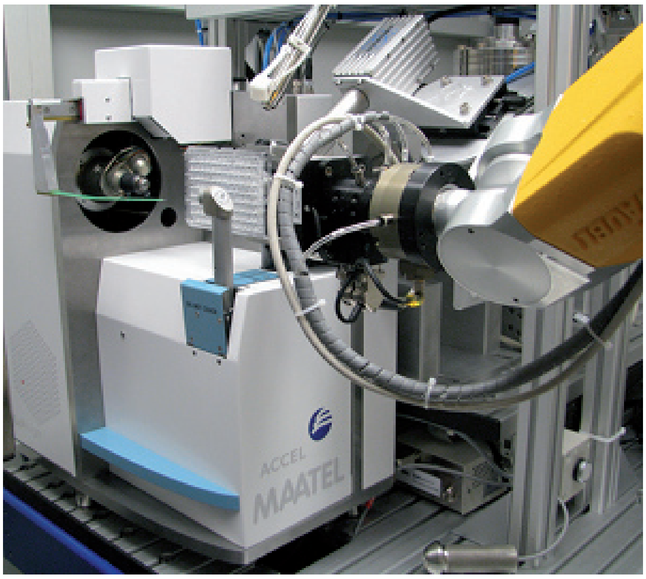

Fig. 1. A 96-well plate mounted ready for X-ray exposure

[1] L. Jacquamet, J. Ohana, J. Joly, F. Borel, M.Pirocchi, P. Charrault, A. Bertoni, P. Israel-Gouy, P. Carpentier, F. Kozielski, D. Blot, J. Ferrer, *Structure* **2004**, *12,* 1219. [2] K.S. Paithankar, M. Hellmig, R. Förster, M.S. Weiss, U. Mueller, *in preparation* [3] U. Mueller, M. Bommer, N. Darowski, R. Förster, M. Hellmig, M. Krug, K.S. Paithankar, S. Pühringer, M. Steffien, M.S. Weiss, *in preparation.*

Keywords: in-situ, bio-macromolecule, synchrotron

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A flexible macromolecular crystallography beamline at the alba synchrotron

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ALBA is a third generation 3-GeV storage ring built near Barcelona and the Universitat Autònoma de Barcelona. Out of the seven first-phase beamlines, XALOC (BL13) is dedicated to Macromolecular Crystallography (MX). The photon source of this beamline is a 2-m long in-vacuum undulator with a period of 21.6 mm and a nominal minimum gap of 5.5 mm. This device has been optimized to deliver the highest flux at the Se K-edge while keeping full tunability in the 5-21 keV range. The optics consists in a cryogenically cooled Si(111) channel-cut crystal monochromator and a pair of mirrors in a Kirkpatrick-Baez or orthogonal configuration. The End Station