The wavefront of vibrational energy emanating from a point disturbance within the crystal is far from spherical, as classically observed in fluids. Although the mathematics of elastic-wave propagation in an anisotropic medium has been known for decades, experimental observation of a vibrational wavefront in a small (micro- or nano-sized) crystal has only been here achieved.

Based on the weird behaviour of acoustic phonons in anisotropic media like crystals, we here present the first development of phonon imaging at high pressure by means of picoseconds acoustics in diamond anvil cell, an advanced and unconventional technique to probe (with a pulsed laser) the structure and elastic behaviour of thin solids under extreme conditions.

Our method gives snapshots that portray the acoustic ray which provides an immediate indication on the complete elastic properties of thin compounds and its evolution under extreme mechanical condition.

The example of single-crystalline silicon up to 10 GPa is presented as a case study [1].

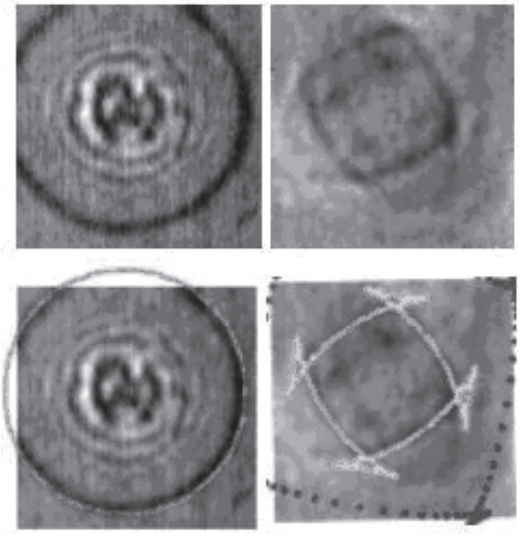

Figure : Top : experimental phonon imaging patterns in the (100) plane of silicon at 7.75 GPa at two different pump-probe delays. Bottom : same as top with superimposed calculation curves for longitudinal, fast and slow transversal group velocities (red, blue and green dashed lines respectively) using C11= 196.9 GPa, C_{12}= 104 GPa and C_{44}= 80 GPa.

[1] F. Decremps, L. Belliard, M. Gauthier, B. Perrin, *Phys. Rev. B* **2010,** *82,* 104119.

Keywords: phonon, pressure, elasticity

MS.47.2

Acta Cryst. (2011) A**67,** C112

High-pressure neutron diffraction at the SNS

Malcolm Guthrie,[a] Reinhard Boehler,[a] Maddury Somayazulu,[a] Timothy Strobel,[a] Georgios Karotsis,[a] Chris Tulk,[b] Antonio M. dos Santos,[b] Jamie Molaison,[b] Neelam Pradhan,[b] [a]*Geophysical Laboratory, Carnegie Institution of Washington, Washington, DC, (USA).* [b]*Oak Ridge National Laboratory, Oak Ridge, TN, (USA).* E-mail: mguthrie@ciw.edu

To date, the role of neutron diffraction in high pressure research has been relatively peripheral, with the vast majority of structural studies using synchrotron-based x-ray diffraction. This is despite well known (and not so well known) advantages of neutrons for crystallography, including: sensitivity to positions of light atoms (in particular H^2, Be, B^{11}, C, N and O), exceptional real-space resolution and the ability to measure long-range magnetic order.

The principle reason for the lack of neutron science under extreme pressure conditions is the intrinsic weakness of available sources and the corresponding need for large sample sizes. To put this in context, current typical sample volumes for neutron powder diffraction are of order 25mm^3 compared with 0.0025mm^3 for diamond-anvil cell synchrotron diffraction. The realisation of such small volumes for neutron diffraction would greatly expand the capabilities of this unique probe.

Recently, the neutron landscape changed with the opening of the 'next generation' 1.4 MW Spallation Neutron Source (SNS) at Oak Ridge National Laboratory. Since then, a collaboration between the Geophysical Laboratory (GL) and the SNS has sought to exploit the SNS's unrivalled, pulsed flux of neutrons for high-pressure crystallography. A key component has been the incorporation of many aspects of GL's experience in high-pressure synchrotron beamlines onto the high-pressure neutron diffractometer, SNAP. This has been coupled with a new generation of diamond anvil cell (DAC) technology tailored to optimize sample volume, and minimise background scattering.

We will present the most recent achievements of this collaboration: diffraction measurements from powder samples, at pressure, inside DAC's with volumes below 0.1mm^3. We will also show the latest attempts to exploit these small volumes to achieve unprecedented pressures for neutron crystallography.

Keywords: neutron, pressure, diffraction

MS.47.3

Acta Cryst. (2011) A**67,** C112-C113

Towards the use of Laue microdiffraction intensities for structural studies at extreme conditions

Catherine Dejoie,[a] Martin Kunz,[a] Nobumichi Tamura,[a] Kai Chen,[b] Simon Teat,[a] Christine Beavers,[a] Lynne McCusker,[c] Christian Baerlocher,[c] [a]*Lawrence Berkeley National Laboratory, Advanced Light Source, Berkeley CA 94720 (USA).* [b]*Lawrence Berkeley National Laboratory, National Center for Electron Microscopy, Berkeley CA 94720 (USA).* [c]*ETH Zurich, Laboratorium f. Kristallographie, Zurich (Switzerland).* E-mail: CDejoie@lbl.gov

Single crystal X-ray diffraction is a most powerful technique to decipher the atomic structure of crystalline material. In its most mature and most precise flavor, monochromatic single crystal X-ray diffraction, the reciprocal lattice of a mounted crystal is rotated through a single Ewald sphere, representing one narrow band pass energy. The drawbacks of monochromatic single crystal X-ray diffraction are the need to rotate the sample through the Ewald sphere and - linked to this - the relatively time consuming data acquisition. The need for a mobile sample makes this technique ill suited for in situ studies such as e.g. laser heated diamond anvil experiments. One possible alternative for such situations is Laue diffraction. By using a broad band-pass X-ray source such as provided for example by a Synchrotron bending magnet, a large number of reciprocal lattice points can be simultaneously imaged in a single exposure.

The potential of Laue diffraction for time resolved in situ experiments has been recognized and exploited by the protein community. In their approach, the Laue specific problems were addressed by the large data redundancy stemming from the large unit cells of typical protein crystals. This approach is not applicable to inorganic substances with relatively small unit cells. We devise ways to extract the integrated intensities from a Laue pattern in cases where high reflection redundancy cannot be achieved. In order to properly interpret intensities, various specific issues such as energy dependent correction factors (absorption, Lorentz