**Recent upgrades at the Partnership for eXtreme Xtallography (PX^2) Project**

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Partnership for eXtreme Xtallography (PX^2) is providing high pressure crystallographic research capabilities for diamond anvil cell research at the GSECARS APS beamline. The PX^2 project is a collaboration between the University of Hawaii and GSECARS, supported by COMPRES and hosted by GSECARS at experimental station 13-BM-C. This beamline provides focused X-rays at a fixed energy of 28.6 keV and a unique 6-circle heavy duty diffractometer, optimized for a variety of advanced crystallography experiments including interface studies, powder and single crystal structure determination, equation of state studies and thermal diffuse scattering. Beamtime of PX^2 is available to all researchers interested in studying deep earth materials through the APS General User Proposal system. PX^2 hosts ~90 groups of users in each calendar year from different institutions all over the world.

In the past year, several new instruments have been added to PX^2. The major hardware upgrade is a new Pilatus3 1M detector with 1 mm thick silicon sensor. This detector is the state-of-the-art time-resolved X-ray area detector for synchrotron research. It replaces the 15-year old MARCCD detector, and features fast-readout rate (25 Hz for Pilatus vs 0.3 Hz for MARCCD), zero background, good quantum efficiency and large dynamic range (20-bit for Pilatus vs 16-bit for MARCCD). With the new Pilatus detector, the data collection time for high pressure single crystal diffraction at PX^2 has been reduced by about 1-2 orders of magnitude. New data collection software and data analysis protocol have also been implemented. To match the time-resolved diffraction capability, the existing optical table and laser heating system at PX^2 have been upgraded, and laser-heated single crystal diffraction studies on silicate minerals have been commissioned at room pressure. We expect to commission laser-heated single crystal diffraction in diamond anvil cells in the near future.