☒ **Talk** ☐ **Poster**

New Research Opportunities for Environmental Scientists at GSECARS post APS Upgrade

Antonio Lanzirotti[1]

[1]*The University of Chicago GSECARS*

...

lanzirotti@uchicago.edu

GeoSoilEnviroCARS (GSECARS) is a national user facility for frontier research in the Earth and environmental sciences using synchrotron radiation, operating Sector 13 at the Advanced Photon Source (APS). The sector consists of bending magnet and insertion device beamlines enabling four simultaneous experiments to run in five stations. Experiments are distributed among five broadly defined Earth science programs, including high-pressure/high-temperature diffraction, scattering, and imaging, surface, interface, and ambient-pressure diffraction, full field X-ray computed microtomography, and X-ray microprobe analysis, including microbeam XRF imaging, XAFS, and XRD. In 2025, GSECARS completed beamline upgrades related to the APS Upgrade that provide exciting new research capabilities, enabled by the vastly improved brightness and coherence of the new storage ring and upgraded beamline optics to take advantage of the new sources.

All the sector 13 beamlines post APS-U we have demonstrated enhanced flux and focusing capabilities relative to pre-upgrade operations. Particularly relevant for environmental scientists, the 13-ID-E microprobe beamline has demonstrated a 5x increase in monochromatic flux (to the 10^{13} photons/sec range) into a submicrometer focused beam over the entire energy range of the beamline. Photon-hungry experiments, for example utilizing the 13-ID-E High Energy Resolution Fluorescence Detected (HERFD) XAFS instrumentation, significantly benefit from the enhanced flux. Another example is the 13-ID-C surface and interface scattering program, which provides researchers tools for studying surface structure and reactivity of minerals, commonly in the presence of fluids of specified composition. APS-U upgrades will allow us to develop new surface-sensitive coherent X-ray scattering techniques that will extend these capabilities to more challenging but important applications such as the reactivity of clay minerals and fine-grained oxide minerals measuring nanometers to microns in size. This talk will highlight the key GSECARS opportunities provided by APS-U.