☒ **Talk** ☐ **Poster**

A ptychographic spectromicroscopy workflow for marine nanoparticles

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Synchrotron scanning transmission X-ray microscopy (STXM) is a well-developed analytical technique that has become widely available at facilities globally (Feggeler et al. 2023). Applications of STXM to geoscience and Earth and environmental science research have yielded discoveries of submicron processes affecting the transport and reactivity of atmospheric aerosols, soil minerals and organic matter, marine trace metals, and more. STXM can be strategically placed within a portfolio of nano-probe, micro-probe, and bulk synchrotron measurements to scale-up observations and add the context of co-occurring elements (Toner et al. 2016). Despite the many contributions of STXM for scientific discovery and hypothesis testing, conventional transmission detection often fails to spatially resolve the finest sample features, such as nanoparticles. X-ray microscopes and nano-probes with ptychography (computed microscopy based on scattering of coherent X-ray photons) can substantially improve spatial resolution of imaging to access these important features (Pfeiffer 2018). In this contribution, we report on our efforts to integrate ptychography into our analytical portfolio for the study of marine nanoparticles. The goal is to increase spatial resolution of imaging while retaining the many advantages of synchrotron X-ray microscopy for analysis of natural particles such as sensitivity to element speciation, detection of co-occurring elements, and minimum sample manipulation prior to analysis. The STXM and ptychography data were collected at the Advanced Light Source, Lawrence Berkeley National Laboratory on beamlines 5.3.2.2 ("polymer" STXM, bend magnet, 200-800 eV) and 7.0.1.2 ("COSMIC" STXM and ptychography, insertion device, 250-2500 eV). Discussion of analysis workflows for ptychography, potential for complementary transmission electron microscopy and microanalysis, and future capabilities that will benefit the geoscience and Earth and environmental science communities will be included.

References

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