**Sample Session Descriptions**

1.1.4 Total Scattering: New Insights in Condensed Matter

While crystallography has traditionally dealt with the average, periodic arrangement of atoms in condensed matter, it has long been acknowledged that deviation from ideality is critically important to understanding macroscopic material phenomena. As atomic structure characterization tools have continued to mature, an increasing body of work has accumulated documenting locally perturbed atomic environments, even in materials of nominally high average symmetry. These studies are often complemented by spectroscopy and microscopy methods to confer a nuanced understanding of materials behavior and inform the materials science paradigm. Beyond the classical examples of diffuse scattering, total scattering and the pair distribution function have been fruitfully applied to numerous contemporary materials science problems, including: ferroic materials, catalysts, strongly correlated electron systems, energy storage materials, as well as bulk/nanoscale variations on each theme. New experimental techniques have also advanced local structure methodologies, particularly regarding advancements in grazing incidence X-ray PDF measurements of thin films, and advancements in the quantitative treatment of electron PDF data. This symposium invites discussion of contemporary scientific developments enabled by local structure investigations of condensed matter.

4.2.3 Sample Prep for Cryo-EM and Crystallography

With the technological advancements in both X-ray crystallography and Cryo-EM, structural biology techniques are becoming readily accessible to all labs. Although we are witnessing many significant strides in this field, preparation of high-quality samples still remains as one of the main bottleneck for both methods. In this session we will highlight the latest sample preparation methods, techniques, and best practices for both crystallography and Cryo-EM single particle, tomography, and micro-ED workflows.

2.1.4 Magnetic Structure Determination: Advances and Applications

Magnetic symmetry is key to understanding and designing many quantum and topological properties materials such as superconductors, quantum spin liquids, spin ices, topological insulators, chiral magnets, and skyrmions. The session will focus on various ideas on how to understand and design quantum and topological materials through magnetic and structural symmetries. We also welcome advanced magnetic and quantum characterization methods to enliven our discussions.

1.1.1 Alternative Methods to Predict and Solve Crystal Structures I

This session aims to showcase work involving alternative methods to traditional single crystal X-ray diffraction for predicting and solving crystal structures of small molecules. Examples include, but are not limited to, three-dimensional electron diffraction, small angle scattering, crystal structure prediction (CSP) methods, solid state NMR techniques, and structure solution from powder diffraction and total scattering data.

**1.2.4 Small Angle Scattering To Characterize Structurally Complex Materials**

Complex materials exhibit hierarchical structures with unique geometries. Structural characterization of such materials is extremely challenging. Small angle scattering, often combined with wide angle scattering and modeling approaches have been playing an essential role in elucidating many of these complex structures. In this session we will discuss recent advances in the characterization of complex geometric systems such as polymers, ceramics, porous materials, lyotropic liquid crystals, and other hierarchical systems formed through self-assembly or multicomponent interactions. The structure that exists within these systems and at their interfaces govern the observed macroscopic properties of the material. Gaining this understanding and therefore control of the structure and interfacial properties will allow for the rational design of new materials for applications ranging from energy storage, gas capture, water purification to food science.

**2.1.2 Structures from Artificial Intelligence**

Over the last four years the field of structural biology, for proteins in particular, has experienced a profound change. At synchrotron facilities data is acquired at a breath-taking speed, leaving many a scientist struggling to keep pace with data handling and analysis. The data resolution achieved with cryo-EM has now safely moved into a range that makes atomic model building routine and cryo-imaging as a whole now enables the study of large, macromolecular machines in situ. Lastly, the unprecedented quality of protein models from structure prediction has opened new ways of conducting research in structural biology. Both, the prediction of structures and the interpretation of large amounts of high-resolution data, require sophisticated, computational models. Hence, machine learning (ML) and artificial intelligence (AI) are now close to becoming standard tools for structural biologists to conduct their data analysis and interpretation. In this session we will look at the most recent ML and AI tools and developments that could now be in any structural biologist’s data analysis repertoire.