The nanostructure problem: challenges, progress, opportunities

Simon J. L. Billinge
Professor of Materials Science and Engineering and Applied Physics and Applied Mathematics
Columbia University

Modern materials under study for next generation technologies, such as for energy conversion and storage, environmental remediation and health, are highly complex, often heterogeneous and nano-structured. A full understanding of the structure requires us to go beyond crystallography and to study the local aperiodic components of the structure, which is a major experimental challenge. There are recently emerging powerful experimental and theoretical developments that are bringing us close to being able to address this problem, ranging from powder to single-particle methods. I will give a personal view about the current state of affairs, highlighting what I see to be the main challenges and opportunities if these can be overcome. The most exciting developments are happening at a nexus of physics, chemistry, applied mathematics and biology and this is a rich and truly interdisciplinary activity.