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[PL3]Plenary Talk 3

Plasticity in crystals and glasses: from the atoms up
Chair: William Curtin(EPFL, Switzerland)
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David Rodney

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Plasticity in crystals and glasses: from the atoms up

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Plasticity in crystalline metals is probably the most classical multiscale process, around which the Multiscale Materials Modeling community first organized at the end of the 1990s. Plasticity in glasses shares many similarities with their crystalline counterparts. In particular, in both cases, plasticity starts at the atomic scale, involving the motion of dislocation cores in crystals and shear transformation zones in glasses. In both cases also, elementary plastic events interact and organize at the mesoscale through elasticity. There are however specific challenges. In crystals, there is currently a need for quantitative and predictive data, which often require to start with a first principles description of atomic interactions. By way of contrast, in glasses, we are still in need of phenomenological information, which can be addressed with less computationally intensive models. But we are then faced with the high complexity of the configuration space and the energy landscape of disordered materials, making it difficult to characterize and predict simply even the most elementary plastic events. The aim of this talk will be to illustrate the challenges, recent progress and opportunities in the field of multiscale modeling of plasticity and to discuss through selected examples the links between atomic and mesoscopic descriptions of plasticity.