Quantum materials as seen by high resolution X ray synchrotron techniques

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Dynamical structural disorder at different length scale plays an important role in the functionality of complex materials [1]. Here different topological templates and weak interactions between building units produce phase separation in different ultrastructure configurations with correlated disorder [2-4]. Achieving optimal material performance requires a quantitative knowledge of this functional correlated disorder, as well as its evolution under external stimuli. In this contest we propose new experimental approaches based on high resolution probes, jointly to advanced modelling and statistical tools for big data analysis [4,5]. Examples of complex functional materials can be found in different fields ranging from biology to quantum science where unique and anomalous properties such as high-temperature superconductivity can emerge, due to the interplay of dopants, charge and spin ordering at nanoscale, in atomic layers or in low-dimensional materials [6-8].

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