

X-ray techniques for studies under extreme conditions at Sirius

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Abstract:

With the advent of fourth-generation synchrotron sources, such as Sirius in Brazil, many opportunities are open to study energy-related materials with conditions yet nonexistent. This is the case, as an example, for superconducting and magnetic materials, for which we still face several challenges in providing a complete and general understanding of their microscopic physical mechanisms. To tackle this problem, we have in place a complex set of interconnected synchrotron techniques to probe several materials under extreme conditions of high pressure/strain, low/high temperature, and high magnetic field. With x-ray spectroscopy and diffraction techniques we can then access such materials' atomic and magnetic structure under those conditions and help draw a clearer picture of their microscopic phenomena. In this talk, I will show how this is possible with a combination of state-of-the-art new instrumentation in our facility to perform several x-ray techniques under non-ambient thermodynamical conditions. In addition, I will show a few examples of studies on superconducting and magnetic materials performed in the first experiments at the extreme condition beamline (EMA) of the new Brazilian Synchrotron source, Sirius. We hope this is just the beginning of an exciting journey into understanding complex and exotic new materials under combined thermodynamical conditions on the atomic and electronic scale.