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The Extreme Condition Beamline, EMA, at Sirius

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The research exploring the limits of thermodynamical parameters, such as pressure, temperature, and magnetic field, is a fast-growing and fascinating discipline of science and technology that unravel many truths and facts of nature, which are not possible in ambient conditions. However, improving the quality of the experimental data obtained at extreme thermodynamical remains challenging. To understand the implication of such huge contraction, small focused X-ray beams, smaller than 1 micrometer, is essential to allow in-situ investigations of the crystalline and electronic structure of materials under high pressure. The Extreme condition Methods of Analysis beamline (EMA), of the new Brazilian synchrotron light source (SIRIUS), was designed to overcome this challenge by having both ~0.5x1 μm^2 focused beam size with high photon flux (10^{13} photons/s @ 10 keV) and ~100x100 nm^2 focused beam size (with ~10^{11} photons/s @ 10 keV), both with well-defined gaussian beam shape, which will allow the realization of X-ray absorption (XAS), X-ray diffraction (XRD), coherent diffraction image (CDI) and X-ray Raman experiments at extreme pressure.

Here, we present the optical parameters and experimental conditions made available at the EMA beamline, along with the recent technical and scientific commissioning results obtained at the beamline. In this study, we demonstrate how EMA uses its bright focused beam to perform diverse experiments combined with state-of-the-art extreme thermodynamic conditions instrumentation, such as high-pressure capabilities at the Mbar regime to low and high temperatures (as low as 300 mK, as high as 8000 K), and high magnetic fields (up to 11T), to explore yet unreached points of the phase diagram. Finally, we also describe the new experimental station, under development, which is optimized for nanometer focusing.

I plan to submit also conference proceedings

No

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