Contribution ID: **132** Type: **not specified**

New opportunities on the studies of matter at extreme conditions in the ESRF-EBS

Wednesday, 15 November 2023 15:30 (15 minutes)

In the last decades, we have witnessed an unprecedented surge in high-pressure research that has greatly improved our fundamental understanding of materials under high compression. The X-ray investigations of matter under extreme conditions has become one of the major activities at the ESRF and other 3rd generation synchrotron sources. The array of techniques includes X ray diffraction, Inelastic X-ray Scattering, Nuclear Inelastic Scattering, X ray absorption and emission spectroscopy, X ray magnetic circular dichroism, X-ray Compton scattering, X-ray magnetic scattering, among many others. As a direct consequence, many scientific breakthroughs have been achieved across fields ranging from fundamental physics to Earth and planetary sciences, chemistry and materials research, and extending into biophysics/biochemistry including questions concerning life and biological function under extreme conditions. Since August 2020, the new ESRF-EBS (extremely brilliant source) opened to the user community a new generation of synchrotron light source with unprecedented characteristics. In particular, the crystallography beamlines dedicated to the studies of materials under extreme conditions (ID15B and ID27) benefit enormously of the beam focusing capabilities and the coherent fraction.

In this presentation, the new capabilities available on ID15B and ID27, very recently reconstructed, will be presented. Also, the strengthen of the user support capabilities on the High-pressure laboratory allow to prepare the most challenging crystallographic studies under extreme pressure (P<2Mbar) and temperature (3K<T<6000K) conditions.

We will discuss particular scientific problems regarding the studies of compounds with charge density in function of high pressure and at low temperature. Finally, the possibilities of collaborations and discussions on possible future beamtime access will be introduced.

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Session Classification: AfLS Contribution

Track Classification: AfLS