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Role of crystal lattice in pressure induced electronic transitions: selected examples

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Superconductivity is an amazing macroscopic quantum many body effect [1]. This phenomena continue to arose the interest of material scientists, physicists and chemists due to a variety of systems which show such an effect and the intriguing nature of the structural effects on superconductivity. This makes the high-pressure structural studies of such systems an important field of research. At the high-pressure diffraction beamline, Xpress, of the Elettra synchrotron, recently we have been involved in such studies [2,3]. One of the key information sought out from these studies is the role of structure in tuning the collective excitations and possible role of such collective excitations in acting as the “pairing glue” for the Cooper pair formation. Systematic high-pressure structural investigations coupled to transport or vibrational spectroscopy studies seems to be very effective [3-5]. There are several emerging new systems where there is a strong connection between the structural properties and the interesting physical properties, where the high-pressure studies are found to provide interesting inputs [3-7] – some examples in this direction will also be discussed.

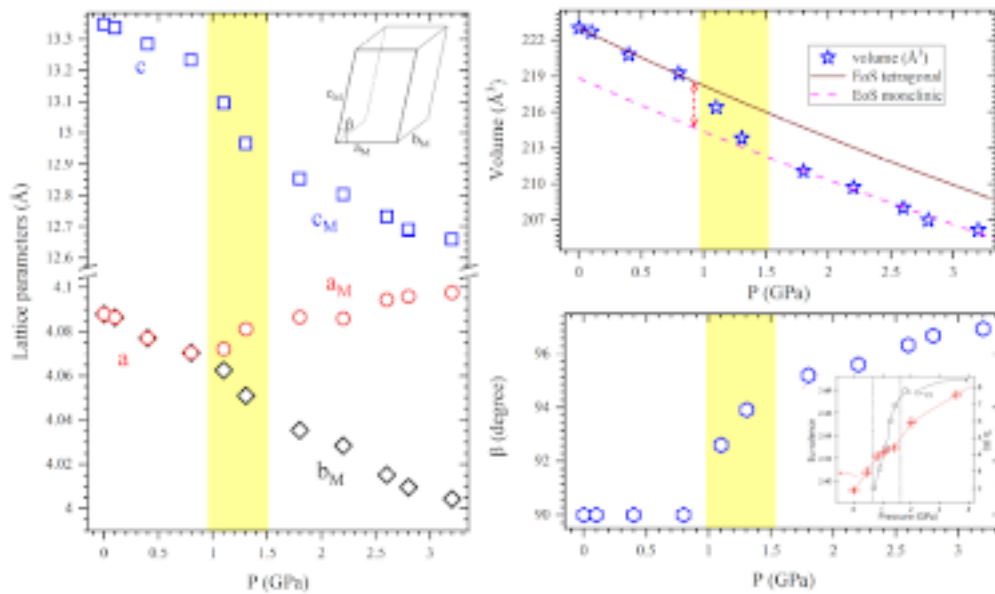


Figure 1:

Figure 1. Pressure evolution of the lattice parameters (a), unit cell volume (c) and the β angle (b) for EuF-BiS₂ [2]. The shaded area in each panel shows the region of phase coexistence marking the structural phase transition. Inset of panel (a) depicts the monoclinic unit cell. Inset in (c) presents the pressure dependence of the superconducting transition temperature together with the Eu valence.

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- [3] U. Dutta et al., Phys. Rev B 2018, 97, 060503(R)
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- [7] S. Pal et al., arXiv:cond-mat 2205.00966

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