Different electronic and magnetic phases in iron-based chalcogenide superconductors

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Competing phases in layered structures are generally characterized by fluctuations of some electronic degrees of freedom, making the functional properties of these materials highly susceptible to local structure and disorder. Here, the case of the 122-type iron-based chalcogenides, showing a peculiar phase separation with coexisting filamentary metallic phase embedded in the insulating texture with large magnetic moment and coexisting filamentary superconductivity, will be discussed. X-ray spectroscopy and scattering results with different physical parameters will be presented. Local magnetic moment associated with the texture appearing with unusual temperature behavior and a large change across the superconducting transition. The anomalous evolution is related with the appearance of an interface phase in the phase-separated system revealed by space resolved x-ray scattering. Different phases are characterized by distinct structural dynamics studied by coherent x-ray scattering. The role of magnetic texture and interface phases will be discussed with different spectroscopy and scattering data obtained in a wide range of temperature.

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