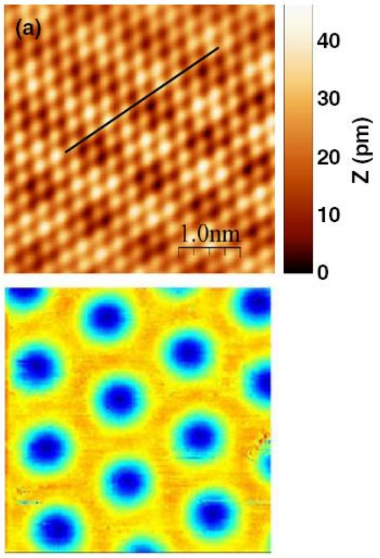
Superconductivity and low Temperature Scanning Tunneling Spectroscopy Laboratory



(top) Atomic resolution STM image of $NbSe_2$ single crystal showing the atoms and the charge density wave modulation. (bottom) Image of the vortex lattice at 350 mK and 0.2T in the same sample obtained using the spectroscopic imaging mode.

Welcome to Superconductivity lab

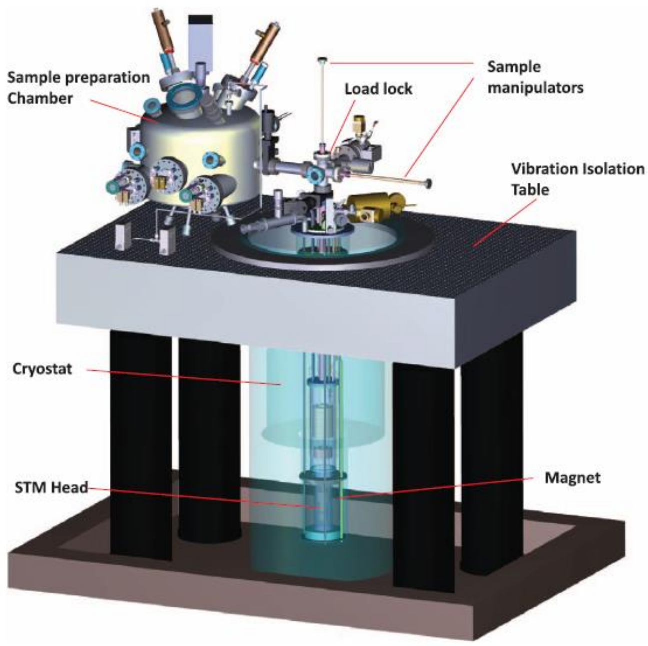
The Superconductivity lab in TIFR is primarily involved with the study of novel ground states that emerge as a result of interaction and disorder in conventional and unconventional superconductors. Our main workhorse, are two state-of-the-art home built scanning tunneling microscopes (STM), operating down to 300 mK and in magnetic fields up to 9T. We complement STM measurements with transport and magnetic measurements in different frequency domains, ranging from dc all the way to microwave. We also use these techniques to look at systems other than superconductors, such as charge density waves and magnetic systems. (*more details on website*)

Tools & Techniques

Our experiments are carried out at cryogenic temperatures of down to 300 mK, achieved using several of ^3He cryostat specially adapted for specific experiments. Our materials for investigation consist of either thin films or single crystals. High quality epitaxial thin films of superconducting and other materials are grown using a variety of techniques including, magnetron sputtering, pulsed laser deposition and thermal evaporation and characterized using tools such as XRD, SEM, EPMA before measurements.

Scanning tunneling spectroscopy

The scanning tunneling microscope (STM) relies on quantum mechanical tunneling of electrons from the surface of the sample to an atomically sharp tip, to obtain an atomically resolved image of the surface. However, the greatest advantage of an STM stems from its ability to simultaneously capture spectroscopic information through the measurement of tunneling conductance, with atomic spatial resolution and unsurpassed energy resolution (<100 μeV). This makes STM particularly suited to study correlated electron systems, including superconductors where exotic electronic states emerge from subtle redistribution of electrons within few meV around the Fermi energy. The TIFR STMs combine, in-situ thin films growth and surface preparation capability, such that measurements can be performed on pristine surfaces, uncontaminated from exposure to air.



Schematic view of the 350 mK scanning tunneling microscope at TIFR.

CURRENT MEMBERS:

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