Title:	Ultra-Low Temperature Magneto-Transport and spectroscopic Imaging
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Abstract:	The size of a physical system and the manifestation of quantum phenomena are closely related. With the size becoming smaller, the number of particles contained by a system is reduced, and the separation between the quantized energy levels increases. Consequently, the system reaches a limit where all or some of the observable phenomena are driven by a few quantum states rather than statistics. A measurable quantum signal is usually very small and also the particle statistics are determined by the system's temperature. As a result, it so happens that even if the size of the system is adequately small, the quantum signal is always suppressed by statistical thermal effects at high temperatures. Thus, quantum phenomena are observed in mesoscopic systems at ultra-low temperatures in general, and detecting such phenomena involves intense cryogenic instrumentation and modeling. This thesis work is divided into two parts. The first part contains our work on the $LaVO_3$ / $SrTiO_3$ interfaces, where we discovered unconventional superconductivity. Further experiments revealed that the interface is highly disordered where superconducting islands separated by a bad metallic background are formed and the islands are percolatively connected. The superconducting phase can also be controlled by tuning the disorder with gate voltage. The second part contains our work on $PtSn_4$, where we have mapped the density of states with Scanning Tunneling Spectroscopy (STS) to extract the Quasi Particle Interference (QPI) pattern due to the presence of defect states. We used the same to reconstruct the momentum space and found evidence of Dirac node arcs. A summary of the thesis is given below chapter wise.
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