Thermoelectric Power of the $LaAlO_3/SrTiO_3$ Heterostructure

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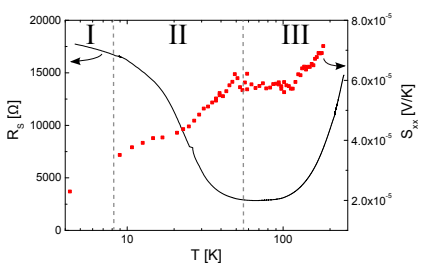
We present a complete set of magneto-resistance (MR), Hall-effect (HE), Seebeck-effect (SE) and Nernst-Ettingshausen-effect (NE) measurements in a temperature-range from 4.2 K up to 250 K and magnetic fields up to 16 T on $LaAlO_3/SrTiO_3$. This only recently discovered system[1] has generated great interest in the recent years[2]. In particular, the heterostructure made of $LaAlO_3/SrTiO_3$ got much attention due to a variety of different properties such as superconductivity[3] and magnetism[4].

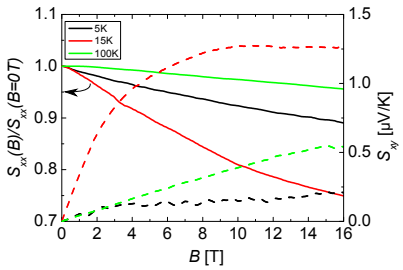
From our data we can distinguish three different regions (figure 1a): The longitudinal resistance (R_{xx}) in region I is weakly decreasing with temperature and shows a small negative magneto-resistance (MR) (not shown). In region II, R_{xx} is decreasing faster and shows a strong non-quadratic MR. At even higher temperatures the resistance is increasing again with a small quadratic MR, marking region III. The Hall-effect (not shown) is small and linear in region I and III and becomes big and non-linear in region II.

The thermopower (S_{xx}) (figure 1a) shows a weak negativ magnetic-field dependence in region I (figure 1b). In region II S_{xx} is increasing with temperature and shows a strong non-linear decrease with magnetic field. In region III S_{xx} shows first a plateau at exactly the same temperature as the minimum in R_{xx} and is increasing further to higher temperatures with a weak and negativ field dependence. The Nernst-effect (figure 1b) is small and linear in regions I and III and bigger and strongly non-linear in region II.

We tentatively interprete this behavior as a result of two different electron-like charge carriers with different mobilities[5], of which one experiences a magnetic, Kondo-like freeze-out.



(a) Temperature dependence of sheet-resistance (black line) and Thermopower S_{xx} (red dots)



(b) Field dependence of Thermopower S_{xx}(solid lines) and Nernst-effect S_{xy} (dashed lines) at 5 K, 15 K and 100 K

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