Electronic Reconstruction and Anomalous Hall Effect (AHE) in the LaAlO$_3$/SrRuO$_3$ Heterostructure

**LaAlO$_3$/SrRuO$_3$-System**
- Epitaxial growth on a SrTiO$_3$(STO) substrate SrRuO$_3$(SRO): alternating layers of Sr$^{2+}$O$_2$- and Ru$^{4+}$(O$^2$)$_2$ → non-polar
- LaAlO$_3$(LAO): alternating layers of La$^{3+}$O$^2$- and Al$^{3+}$(O$^2$)$_2$ → polar

→ possible electronic reconstruction → 2D charge pinning at the interface of ferromagnetic, metallic SRO and LAO [1,2]

**Topological Phase Transition**
Caviglia group [1]:
- Topological phase transition of SRO band structure depending on film thickness
  → sign change of AHE $\rho_{xy}$

**Structural Properties**

- Growth of high quality thin films by pulsed laser deposition (PLD)
- Monitoring by reflection high energy electron diffraction (RHEED)

**Anomalous Hall Effect (AHE)**
- Theory in [1]: AHE of intrinsic origin
  → non-zero Berry curvature
- Temperature-dependent sign-change in close proximity to the magnetic phase transition
- Change of slope indicates change of carrier type
- Inverted AHE for LAO(4)/SRO(6) compared to LAO(4)/SRO(10) → change of film thickness induces topological phase transition

**Transport Measurements**
- SRO undergoes thickness dependent metal-insulator transition [3]
- For 6 uc and 10 uc SRO: ≥ 4uc LAO capping drives SRO films metallic

**References**

**Summary**
- Insulating but polar LAO-capping pushes SRO (deeper) into the metallic regime thereby modifying the electronic ruthenium states
- Strong evidence for electronic reconstruction induced by the LAO-capping, accompanied by a topological phase transition as function of SRO thickness