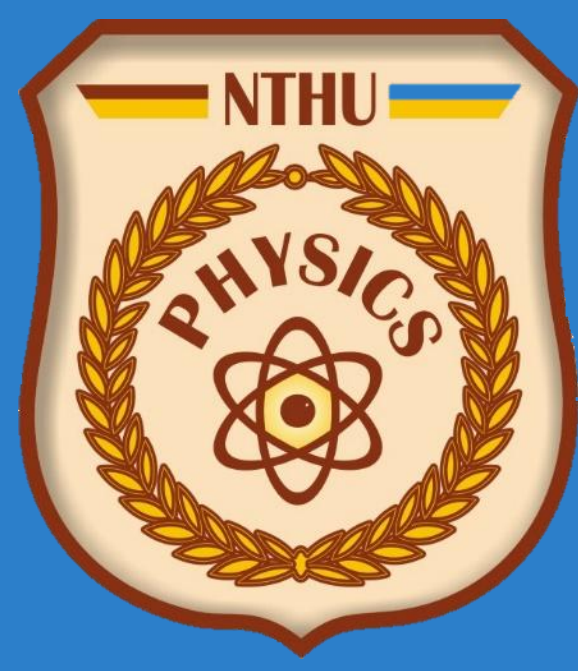


# H-linear magnetoresistance in the $T^2$ resistivity regime of overdoped infinite-layer nickelate $\text{La}_{1-x}\text{Sr}_x\text{NiO}_2$



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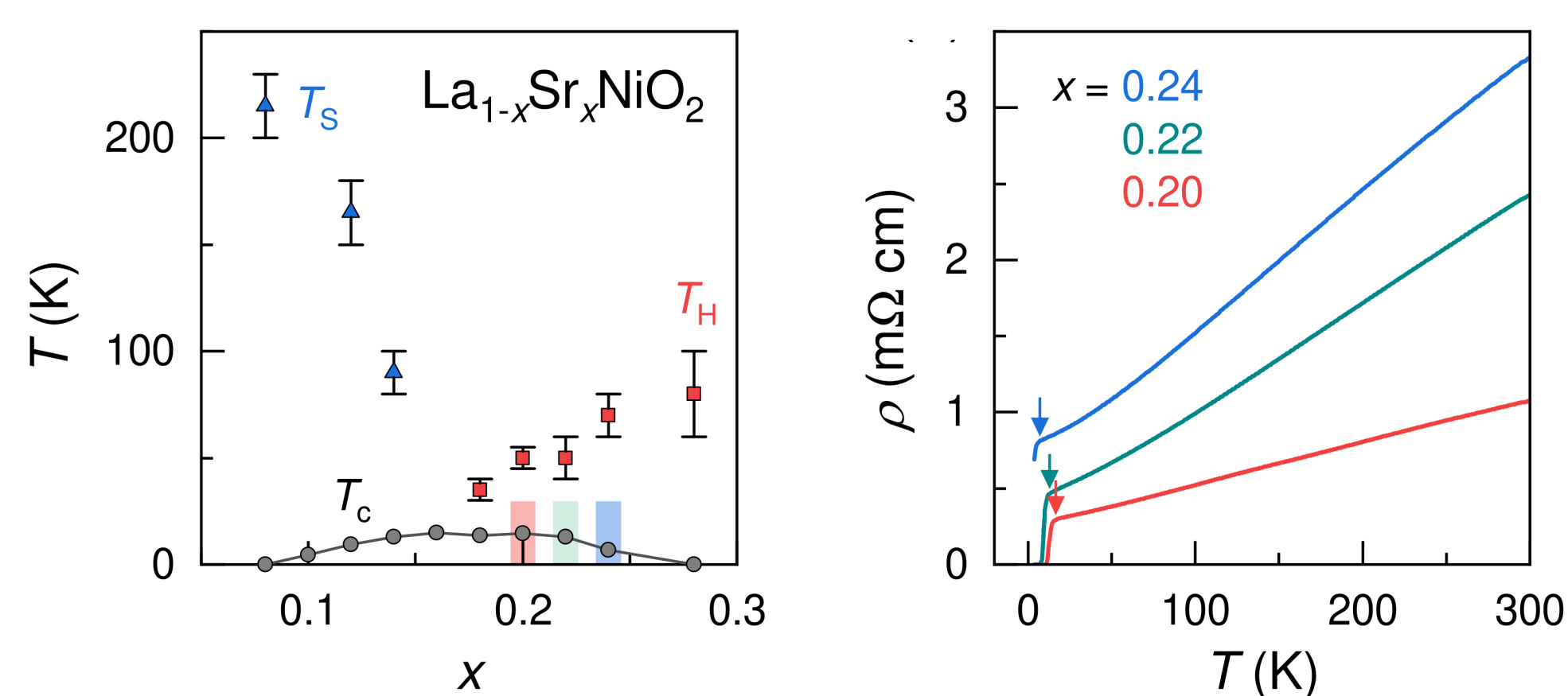
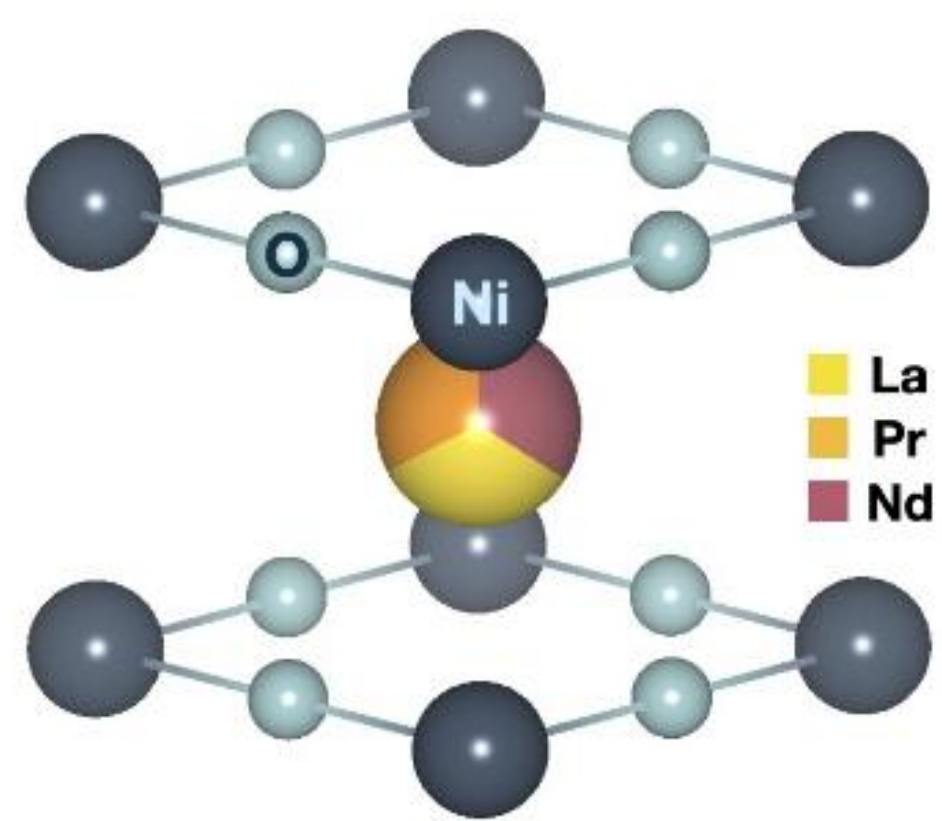
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We report a systematic magnetotransport study on high-crystallinity  $\text{La}_{1-x}\text{Sr}_x\text{NiO}_2$  (LSNO) thin films with  $x = 0.20 - 0.24$ . By pulsed-field transport experiment up to 62 T, we reveal that: (1) the magnetoresistance does not follow the conventional Kohler's rule but exhibit a  $H$ -linear behavior in the high  $H/T$  limit and (2) the normal-state resistivity below 30 K follows a  $T^2$  behavior consistently across the overdoped regime. Our results demonstrate a coexistence of  $H$ -linear magnetoresistance and  $T^2$  resistivity in a model unconventional superconductor, providing new information on the characteristics of the normal ground state that host superconductivity in infinite-layer nickelates.

## Introduction



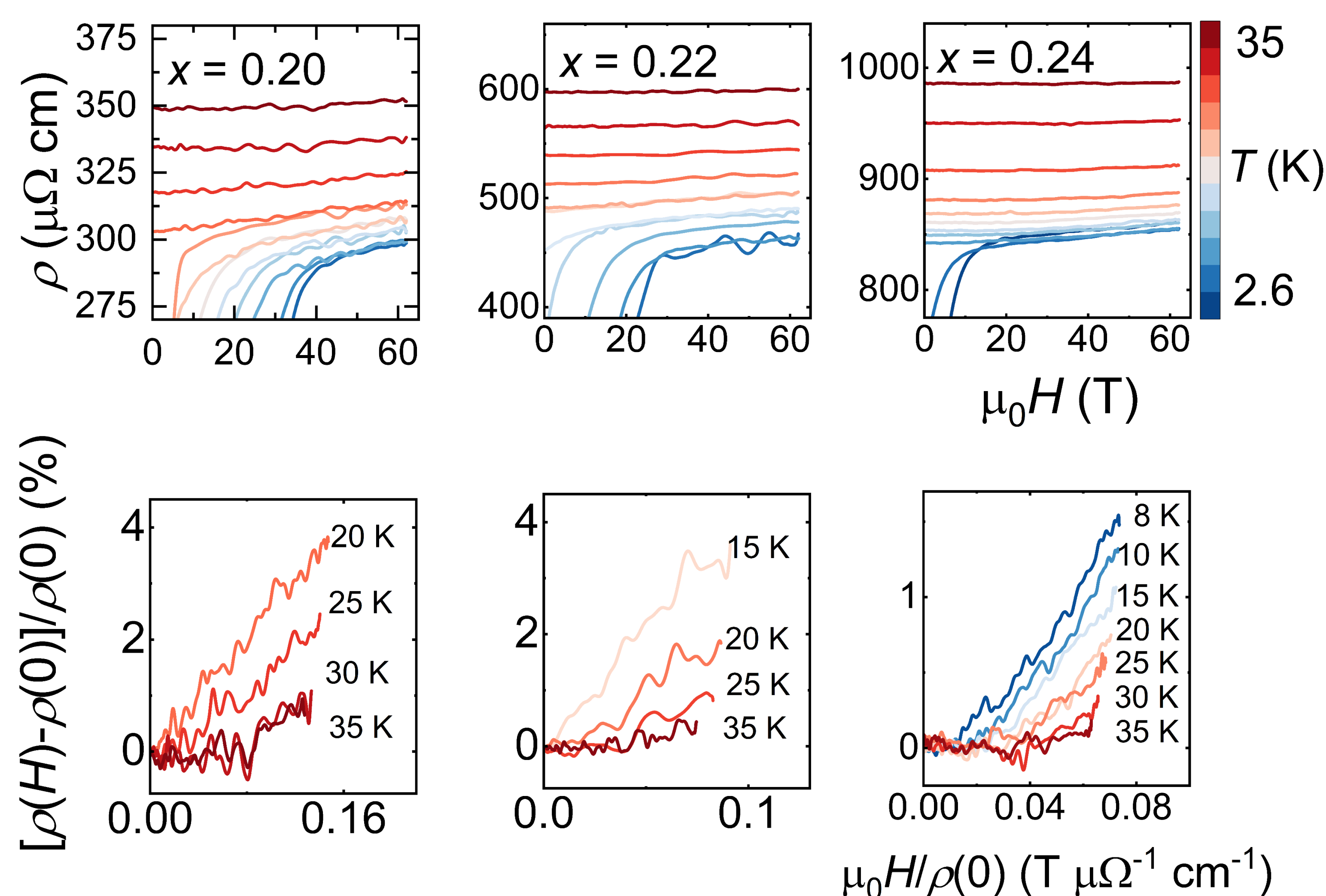
Left: crystal structure of infinite-layer rare-earth nickelates [1]. Middle: phase diagram for LSNO [2].  $T_S$  and  $T_H$  are sign-change temperature of Seebeck and Hall coefficient. The optimized doping is  $x_{\text{opt}} \approx 0.16$

Right: zero-field resistivity of overdoped LSNO. For  $x = 0.20, 0.22$  and  $0.24$ , their critical temperature  $T_c$  are 16.5, 13.1 and 6.8 K.

## Methods

LSNO thin film were synthesized using pulse-laser deposition technique [2]. High-field magneto-transport measurements up to 62 T were performed in the High Field Laboratory (HLD-EMFL) in Dresden, Germany.

## Pulsed-Field Magnetoresistivity



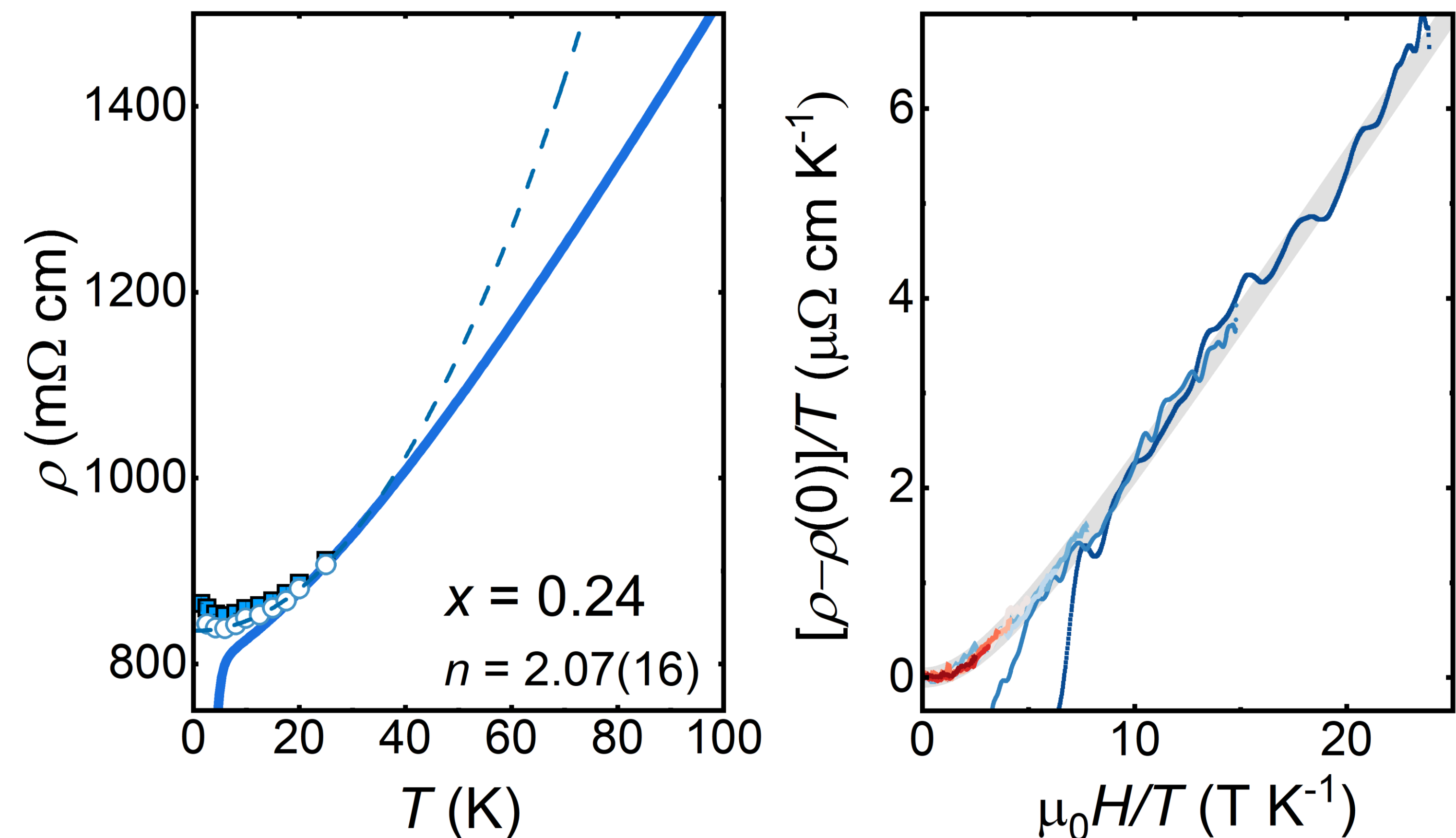
High-field magnetoresistivity (upper row) and Kohler plot (lower row) of overdoped LSNO. A clear violation of Kohler scaling rule is found.

Kohler scaling rule:

$$[\rho(H, T) - \rho(0, T)]/\rho(0, T) \propto \mathcal{F}(\mu_0 H/\rho(0, T))$$

Characteristic of conventional metals

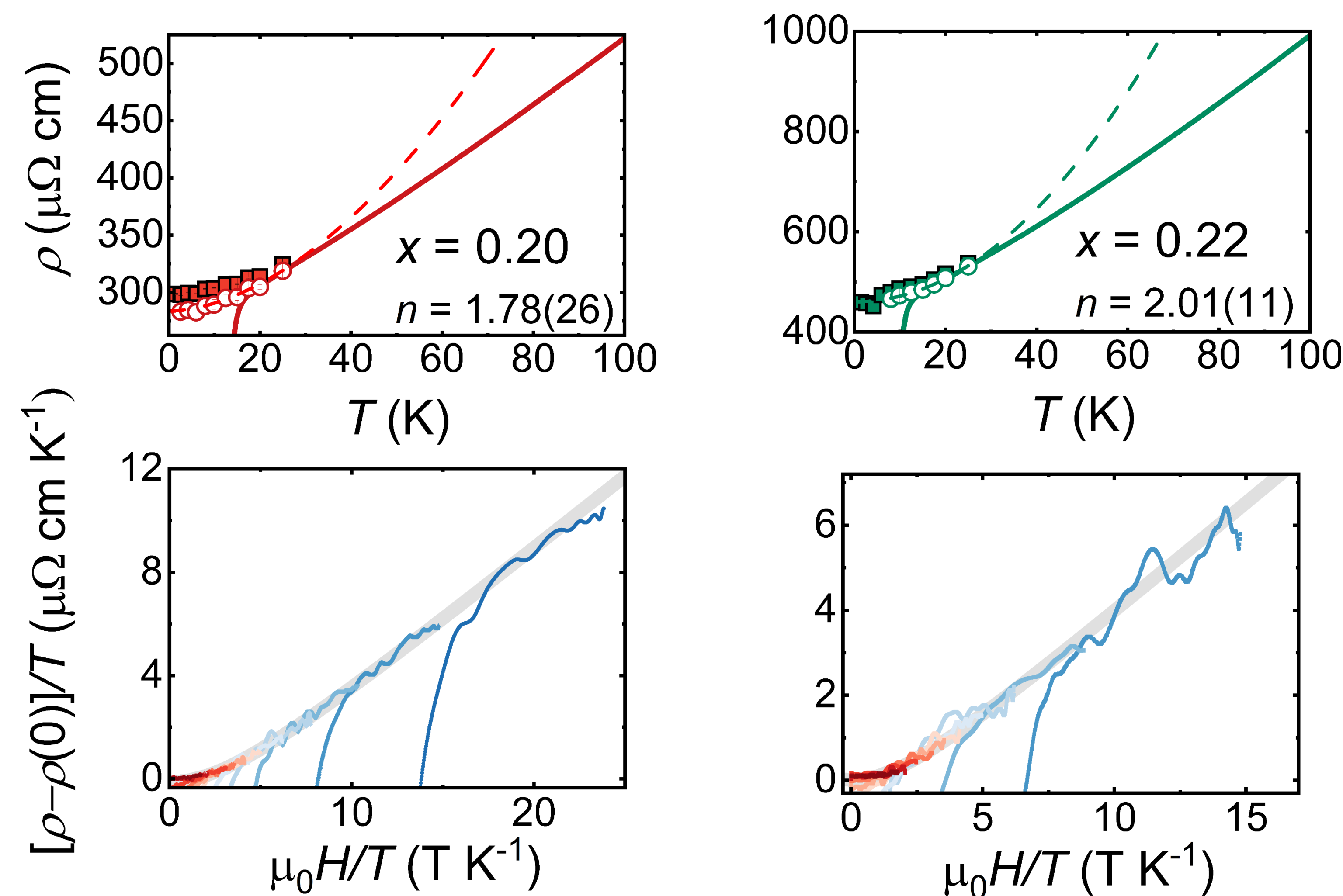
## Normal-State Magnetotransport



$H/T$  quadrate scaling:

$$\rho(H, T) - \rho(0, 0) \propto \sqrt{(\alpha k_B T)^2 + (\gamma \mu_B \mu_0 H)^2}$$

Characteristic of strange metals [3]



Normal-state transport character of overdoped LSNO films. The low  $T$  resistivity exhibit a  $T^2$ , Fermi-liquid-like behavior. Meanwhile, the magnetoresistivity shows a  $H$ -linear behavior at high magnetic fields with  $H/T$ .

## Conclusion

1. Low-temperature normal-state resistivity exhibit Fermi-liquid-like behavior, i.e  $\rho(T) \propto T^2$
2. Simultaneously, their magnetoresistivity exhibits strange-metal-like behaviors following  $H/T$  scaling

## Reference

- [1] B. Y. Wang et al. Sci. Adv. 9, eadf6655 (2023)
- [2] M. Osada et al. Sci. Adv. 11, eadv6488 (2025)
- [3] I. Hayes et al. Nat. Phys. 12, 916–919 (2016).