International CRP 2022—Category A

Quantum Dynamics of Charge and Spin Orders in Highly Correlated Electron Systems

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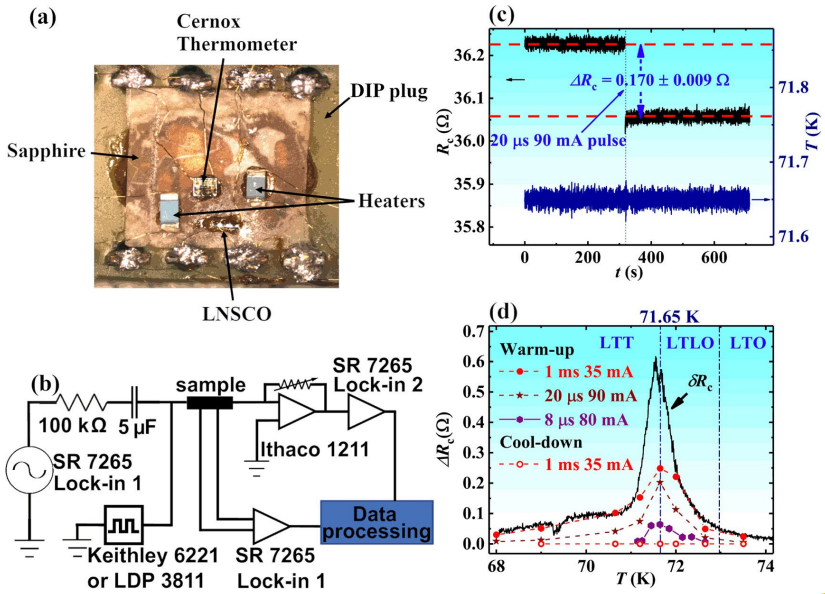
- Aims of Research -

In order to study the quantum dynamics of charge/spin-orders in highly correlated electron systems, we developed a technique in which electrical pulses were applied to drive the charge/spin-orders out of equilibrium and their response was studied using electrical transport measurements.

- Results -

Using the experimental setup as shown in Figs. (a) and (b), we studied a high temperature superconductor $La_{1.48}Nd_{0.4}Sr_{0.12}CuO_4$, in which charge-order is in the form of stripes. Fig. (c) shows a representative effect of a single current pulse on the *c*-axis resistance R_c. The pulse induces switching to a stable, lower resistance state, with ΔR_c defined as the drop in R_c after the pulse. Similar measurements were performed with different amplitude I_p and duration τ of current pulses at various temperature, with each measurement carried out after either a warm-up or a cool-down protocol. ΔR_c had a maximum at temperature near the charge-order onset [Fig. (d)], demonstrating that, for small enough perturbation, pulsed current injection allows access to nonthermally induced resistive metastable states.



[1] Z. Shi, P.G. Baity, J. Terzic, B.K. Pokharel, T. Sasagawa, and D. Popović, Nature Commun. **12**, 3724 (2021).
[2] B.K. Pokharel, Y. Wang, J. Jaroszynski, T. Sasagawa, and D. Popović, Appl. Phys. Lett. **118**, 244104 (2021).