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M3Or4O-03: [Invited] Non-linear electrical transport on superconducting thin films in pulsed magnetic fields

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Nonlinear electrical transport is an indispensable tool to study disorder, dimensionality, criticality, and vortex physics for fundamental research on new types of superconductors and technological applications. Because a significant portion of many superconducting phase diagrams occurs at very high magnetic fields (H) only accessible by pulsed field magnets, there is a need to develop non-linear transport capabilities compatible with the stringent challenges imposed by pulsed fields. Among the many technical challenges of performing non-linear electrical transport measurements in pulsed fields, short pulse durations (˜50 ms) and large dH/dt values (˜10^4 T/s) are perhaps the most difficult. Large dH/dt values are especially challenging because they generate vortex motion which competes with current induced vortex motion [1]. In this talk, I will show recent developments at the National High Magnetic Field Lab's Pulsed Field Facility which enable efficient, non-destructive, non-linear electrical transport measurements in pulsed fields. With our state-of-the-art system, we can collect, and immediately analyze, non-linear electrical transport data utilizing the entire field range (55T) accessible within a single pulse [1, 2]. I will present critical current and critical field measurements on $YBa_2Cu_3O_{7-x}$ thin films with different, artificial pinning centers which demonstrate our capabilities, and explore the influence of the irreversibility line on critical currents at low temperatures and in fields up to 65T. Comparisons will also be drawn between the properties of superconducting cuprate thin films and the newly discovered nickelate family of superconductors.

[1] M. Leroux, F.F. Balakirev, M. Miura, K. Agatsuma, L. Civale, and B. Maiorov, *Phys.Rev.Appl.* **11**, 054005 (**2019**).
[2] C.A. Mizzi, F.F. Balakirev, B. Maiorov, et al., *In preparation.*

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