Flux quanta driven by high-density currents in low-impurity V_3Si and $LuNi_2B_2C$: Free flux flow and core size effects[1]

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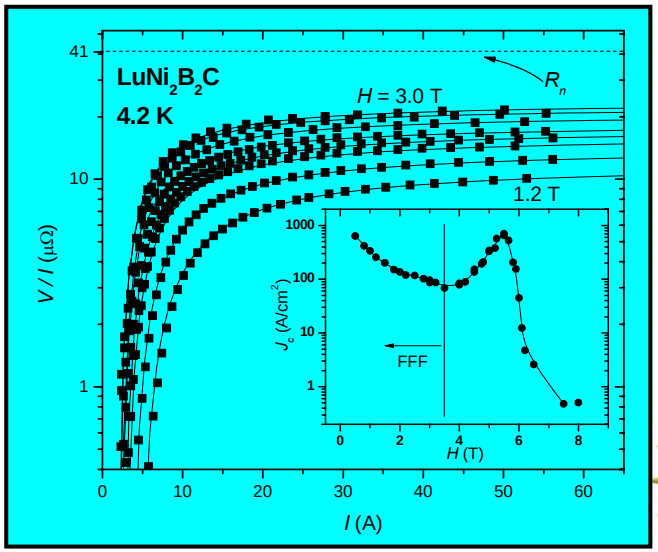
Subject: electromagnetic properties of superconductors

- Many superconductors contain interacting **quanta** of **magnetic flux** at certain fields *H* and temperatures *T*.
- Transverse motion of flux quanta **("flux flow"):** driven by applied current, manifested by dissipative voltage.
- **"Free" flux flow (FFF):** flux quanta move together in highly ordered fashion, technically difficult to achieve.
- Focus: How free flux flow is affected by the size of the *cores* of flux quanta.

- Flux flow is impeded ("pinned") by impurities: FFF is realized only in low-impurity samples *and* when driven by high current densities (~10^3 A/cm^2). Dissipative flux-flow voltage measured as flux flow resistivity ρ_f.
- At high enough currents, ρ_f approaches a *constant value* (left figure) which in turn is correlated with the amount of applied magnetic field *H*.
- This dependence of ρ_f on *H* has been predicted to be affected by the size of flux quantum cores, which also depends on *H*.

• Main result: When core size is assumed *non*-dependent on *H*, $\rho_f(H)$ is linear (model: Bardeen-Stephen flux flow, BSFF – right figure). Instead, $\rho_f(H)$ is consistent with a model based on a field dependent core size ("KZ"[2]), and – in measuring two different compounds – is confirmed to be independent of composition.



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2. Kogan and Zelezhina, *Physical Review B* **71**, 134505 (2005).

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