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Characterization of vortex pinning through the Campbell length
ROLAND WILLA, VADIM B. GESHKENBEIN, GIANNI BLATTER, Institute for Theoretical Physics, ETH Zurich, 8093 Zurich, Switzerland — Vortex pinning is decisive in establishing dissipation-free current flow in a type-II superconductor; knowledge and optimization of the pinning landscape (pinscape) is of major importance for applications. The *ac* magnetic response, characterized by the Campbell penetration depth λ_C [1], provides valuable information on the pinscape, besides the critical current density j_c. While microscopic derivations of j_c are available both in the weak and strong pinning limits, this is not the case for the Campbell length, whose understanding has remained on a phenomenological level so far. Based on the microscopic theory of strong pinning, we have established a proper link between the Campbell length and the pinscape parameters. This new quantitative formalism [2] captures all experimentally observed signatures [3], among which are the dependence of λ_C on the vortex state preparation and the hysteresis in λ_C upon thermal cycling the field-cooled state. [1] A.M. Campbell, J Phys C: Solid State Physics 2, 1492 (1969), ibid. 4, 3186 (1971) [2] R. Willa, V.B. Geshkenbein, and G. Blatter, PRB 92, 134501 (2015), R. Willa, V.B. Geshkenbein, R. Prozorov and G. Blatter, PRL in press [3] R. Prozorov et al., PRB 67, 184501 (2003), H. Kim et al., PRB 87, 094515 (2013)

Roland Willa
Institute for Theoretical Physics, ETH Zurich, 8093 Zurich, Switzerland

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