PC3-1-INV

Strong pinning theory: a review

*Roland Willa[1]

Karlsruhe Institute of Technology[1]

For more than two decades the description of vortex pinning was dominated by the qualitative theory of weak collective pinning, where the cumulative (statistical) action of many weak defects prevent vortex motion. Proposed already in the late sixties, the theory of strong vortex pinning [1,2] takes the opposite approach: few strong defects plastically deform the flux-lines and individually pin the vortex lattice. A complete framework has been developed over the last years to quantitatively predict macroscopic observables within the strong pinning regime, among which the critical current [3], the excess-current characteristic at zero temperature [4], the Campbell response to ac perturbations [5], and vortex creep [6]. I will revisit these analytic developments, explore with the help of analytic and numerical tools the regimes of higher defect densities [7], and bring the results in contact with recent experiments.

References

[1] R. Labusch, Cryst. Lattice Defects **1**, 1 (1969).
[2] A.I. Larkin and Y.N. Ovchinnikov, J. Low Temp. Phys. **34**, 409 (1979).
[3] G. Blatter, V.B. Geshkenbein, and J.A.G. Koopmann, Phys. Rev. Lett. **92**, 067009 (2004).
[4] A.U. Thomann, V.B. Geshkenbein, and G. Blatter, Phys. Rev. Lett. **108**, 217001 (2012) and Phys. Rev. B **96**, 144516 (2017).
[5] R. Willa, V.B. Geshkenbein, R. Prozorov, and G. Blatter, Phys. Rev. Lett. **115**, 207001 (2015), R. Willa, V.B. Geshkenbein, and G. Blatter, Phys. Rev. B **92**, 134501 (2015), and Phys. Rev. B **93**, 064515 (2016).
[6] M. Buchacek, R. Willa, V.B. Geshkenbein, and G. Blatter, Phys. Rev. B **98**, 094510 (2018) and Phys. Rev. B **100**, 014501 (2019).
[7] R. Willa, A.E. Koshelev, I.A. Sadovskyy, and A. Glatz, Supercond. Sci. Technol. **31,** 014001 (2018) and Phys. Rev. B **98**, 054517 (2018).

Keywords: strong pinning, theory, vortex matter