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Tuning the Phase Diagram of MgB_2 through Magnetic and Non-magnetic Doping[1] E.R. DE WAARD, University of Notre Dame, S. MANNI, P.C. CANFIELD, Ames Laboratory, J. BARKER, National Institute of Standards and Technology, C.D. DEWHURST, Institut Laue-Langevin, France, M.R. ESKILDSEN, University of Notre Dame — Small-angle neutron scattering (SANS) studies of the vortex lattice (VL) in MgB_2 have revealed a complex VL phase diagram as well as an unprecedented degree of metastability that is demonstrably not due to vortex pinning, [C. Rastovski *et al.*, Phys. Rev. Lett. **111**, 107002 (2013)]. The VL phase diagram is governed by non-local vortex-vortex interactions, which depend sensitively on Fermi surface anisotropies and the mean free path of the host superconductor. We have investigated the effects of modifying the vortex-vortex interaction by non-magnetic (C) as well as magnetic (Mn) doping. SANS studies revealed substantial modifications of the VL phase diagram in single crystals of $Mg(B_xC_{1-x})_2$ and $(Mg_xMn_{1-x})B_2$. In the Mn-doped case, a large increase in the longitudinal correlation length (ξ_L) was observed. However, VL metastability was still present despite this increase of vortex pinning.

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Elizabeth De Waard
University of Notre Dame

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