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Disorder Induced Magnetic Memory MICHAEL S. PIERCE, University of Washington — To test theories of random microscopic disorder, we first developed and then applied coherent x-raymetrology to a series of thin multilayer films with perpendicular magnetic anisotropy anddegrees of disorder. We used coherent x-rays to generate speckled scattering patterns. The "random" arrangement of the speckles is due to the exact configuration of the magneticin the sample. Changes in the domain structure change the speckles, and comparison of thespeckle patterns provides a quantitative determination of how much the domain structure has. We asked (and answered) two important questions. How is the magnetic domain configuration at one point on the major hysteresis loop related to the configurations at the same point on the loop during subsequent cycles: microscopic return point memory(RPM)? We found the RPM is partial and imperfect in the disordered samples. How are the magnetic domains at one point on the major loop related to the domains at the inversion symmetric point on the loop, during the same and during subsequent cycles: microscopic complementary point memory(CPM)? We found the CPM is also partial and imperfect in the disordered samples. In addition, we found that RPM is always larger than CPM. No existing theory was capable of reproducing our results. We developed newthat do fit our observations. Our experimental and theoretical results set new benchmarks forwork.

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