Spatially Homogeneous Ferromagnetism of (Ga,Mn)As Detected by Muon Spin Relaxation

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Muon spin relaxation (μSR) probes magnetism yielding unique information about the volume fraction of regions having static magnetic order, as well as the size and distribution of the ordered moments [1,2]. By combining low-energy μSR, conductivity, and ac- and dc-magnetization results obtained on seven high quality thin-film specimens with T_C ranging from 0 to 140 K, we demonstrate that (Ga,Mn)As exhibits a sharp onset of ferromagnetic order, developing homogeneously in the full volume fraction, in both insulating and metallic films [3]. Smooth evolution of the ordered moment size across the insulator-metal phase boundary indicates strong ferromagnetic coupling between Mn moments that exists before the emergence of fully-itinerant hole carriers. The present results give strong encouragement to reliable application of (Ga,Mn)As in spin-sensitive devices.

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