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Experimental studies of skyrmion textures and spin torque effects in chiral magnets

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Small angle neutron scattering and measurements of a topological Hall signal identify the formation of skyrmion lattices in the non-centrosymmetric B20 compounds MnSi [1], $Mn_{1-x}Fe_xSi$, $Mn_{1-x}Co_xSi$ and the strongly doped semiconductor $Fe_{1-x}Co_xSi$ [2]. This observation has been confirmed by Lorentz force microscopy in thin samples of $Fe_{1-x}Co_xSi$, FeGe and, most recently, MnSi, where even individual skyrmions have been spotted [3]. Because the skyrmion lattices are exceptionally weakly pinned to the crystal lattice, extreme care has to be exercised when studying the precise intrinsic morphology of related spin textures in bulk samples. As a particularly striking property each skyrmion supports precisely one quantum of emergent magnetic flux. This permits a highly efficient coupling between skyrmions and conduction electrons which results in spin torque effects at ultra-low current densities as seen in small angle neutron scattering [4] and the emergent electric field when the skyrmions move [5].

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