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Magnetism in iron-based high-temperature superconductors and its effect on lattice and superconductivity[1]

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Shortly after the discovery of iron-based high-temperature superconductors in 2008, extensive studies using neutron and x-ray scattering techniques have revealed a strong interconnection of magnetism, lattice and superconductivity. In this presentation I will give an overview of the complex interplay between these phenomena and will bring it into context with other unusual superconductors. I will illustrate the phase relations exemplarily on the family of $A\mathrm{Fe_2As_2}$-based material (A = Ba, Sr, Ca) where a stripe-like antiferromagnetic order is coupled to a lattice distortion implying a strong coupling between magnetism and structure. Partial chemical element substitution suppresses these transitions and superconductivity occurs.

The study was performed in collaboration with M. G. Kim*, G. S. Tucker*, D. K. Pratt*, S. Nandi*, W. Tian#, J. Zarestky*, J.-W. Kim+, G. E. Granroth*, K. Marty#, M. D. Lumsden#, T. Heitmann=, A. Thaler*, N. Ni*, S. L. Bud'ko*, P. C. Canfield*, R. M. Fernandes*, J. Schmalian*, R. J. McQueeney*, and A. I. Goldman*; *Ames Laboratory, and Iowa State University; +APS, Argonne; #HFIR, Oak Ridge; =MURR, University of Missouri.

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