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Unique magnetic properties in simple metals

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Abstract :

Antiferromagnetic (AFM) spin-density-wave (SDW) systems exhibit a wide range of characteristics and phase transitions making them extremely interesting to study. Features include quantum critical behaviour, superconductivity, proximity induced magnetism, spin-glass properties, negative giant magneto resistance (GMR), as well as invar and el-invar qualities. The richness of characteristics makes these materials useful for application in many modern industries using novel materials that can easily be tailored and structured. In addition, many of the fundamental properties of SDW AFM materials can only now be probed further by considering measurements at extreme conditions, such as low temperature, high magnetic fields and pressure. Cr and its alloys are archetypical in the investigation of compounds with an itinerant AFM SDW formation because of electron-hole condensation during the nesting of electron-hole Fermi sheets [1]. The recent discovery that this relatively 'simple' AFM SDW metal can be driven to a quantum critical point by alloying and/or by pressure [2,3,4] reignited investigations into these alloys. Correlations are seen between the relatively simple AFM Cr-alloys and other more complex AFM compounds. One such property is the incommensurate (I) SDW fluctuations seen in the paramagnetic phase in Cr that correlates with the ISDW fluctuations in high temperature superconducting cuprates such as $La_{1-x}Sr_xCuO_4$ [5]. This contribution aims to discuss the richness in the variety of magnetic phases observed in the magnetic phase diagrams of AFM SDW alloy systems, superconducting properties, as well as critical points. Furthermore work on thin films and heterostructures, with reference to Cr and Cr-alloys will be briefly introduced. From recent discoveries it is evident that several areas of research regarding itinerant AFM SDW systems are still developing and more stimulating research on these systems can still be done in future.References:[1] Fawcett et al. Rev. Mod. Phys. 66 (1994) 25 [2] Yeh et al. Nature 419 (2002) 459 [3] Lee et al. Phys. Rev. Lett. 92 (2004) 187201-1 [4] Jaramillo et al. PNAS 107 (2010) 13631 [5] Mason et al. Phys. Rev. Lett. 68 (1992) 1414

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