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Lattice dynamics and magnetic order in CrAs under pressure

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Pressure induced superconductivity in CrAs has been discovered in June 2014, opening a new avenue for searching novel superconductors in Cr and other transition based compounds [1,2]. CrAs belongs to the group of 3d electron systems which can offer stages which induce intriguing superconductivity as realized in cuprates, Fe pnictides, cobalt oxyhydrate, etc. In Cr- and Mn-based systems this behaviour has so far not been observed. The application of external pressure, however, leads to superconductivity in CrAs in the vicinity of antiferromagnetic order. CrAs is paramagnetic at room temperature and shows a first order magnetic phase transition at 265 K to a helimagnetic phase. The magnetic transition is suppressed at higher pressures where superconductivity appears in the paramagnetic phase at low temperature.

In order to investigate the origin of superconductivity in CrAs we perform neutron diffraction to study the magnetic structure under pressure [3], inelastic x-ray scattering to determine the phonon dispersion relations and ab initio calculations to address spin-lattice coupling.

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[2] H. Kotegawa, S. Nakahara, H. Tou, and H. Sugawara, J. Phys. Soc. Jpn. 83, 093702 (2014).
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