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Study of phase transitions on Intermetallic superconducting compounds

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The ternary stannide superconductors with the general formula A3T4Sn13[1] (A=Alkaline Earth or Rare Earth metal; T=Rh,Ir) having Quasi-Skutterudite structure have attracted a lot of attention due to Unconventional Superconductivity, non-Fermi liquid behaviour, Anti-Ferromagnetic (AFM) and Charge Density Wave (CDW) orders. The origin of the superlattice reflections in one such superconducting ternary stannide Ca3Ir4Sn13 at low temperatures has been investigated in the present work using Inelastic Neutron Scattering (INS) and Single-Crystal X-Ray Diffraction. Our data suggests the development of a CDW order associated with the freezing of a low energy phonon mode as the cause for the superlattice peaks below $T^* \approx 38$K. The existence of a possible Quantum Critical Point (QCP) in the phase diagram of these stannides [2] has also been explored by introducing suitable chemical doping.

[1] Remeika J.P. et al., A new family of ternary intermetallic superconducting/magnetic stannides Solid State Communications, Volume 34, Issue 12, June 1980, Pages 923–926
[2] Klintberg. L.E et al., Pressure- and Composition-Induced Structural Quantum Phase Transition in the Cubic Superconductor (Sr,Ca)3Ir4Sn13 Phys. Rev. Lett. 109, 237008 (2012)

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