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Synthesis, characterization, electronic structure, and phonon properties of the noncentrosymmetric superconductor LaPtSi

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Abstract

In the present work we report on the synthesis, crystal structure, and physical properties (resistivity, magnetization, heat capacity) in combination with density functional theory (DFT) calculations of the electronic structure and phonon properties for the intermetallic compound LaPtSi. LaPtSi crystallizes in its own noncentrosymmetric structure type (space group I41md; a=0.42502(1) nm and c=1.4525(5) nm), which is an ordered ternary derivative of the centrosymmetric α-ThSi2-structure. The weakly correlated compound LaPtSi (Sommerfeld value γ=6.5 mJ/molK2) exhibits superconductivity below Tc=3.35 K and appears to be a fully gapped, weakly coupled s-wave BCS superconductor. The experimental observations are supported by DFT calculations which show that, despite a substantial spin-orbit splitting of the Fermi surfaces, a spin-singlet pairing is prevalent.