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Charge-density waves in $EuAl_4$ and $SrAl_4$

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Abstract

A charge-density wave (CDW) may develop in quasi-1-dimensional (1D) metallic crystals at low temperatures. It describes a modulation of the density of the conduction electrons and of the positions of the atoms according to a wave with a single modulation wave vector **q** [1]. The classical CDW is explained by the mechanism of Fermi-surface nesting (FSN), where **q** connects to each other different parts of the Fermi surface. The atomic displacements can be measured by X-ray diffraction (XRD). More recently, CDWs have been found in metals whose crystal structures and physical properties lack obvious 1D features [1, 2]. Mechanisms have been put forward, that provide alternative explanations for the formation of CDWs. In particular this includes **q**-dependent electron-phonon coupling (EPC).

Here, we present comprehensive studies towards the CDWs in the materials $EuAl_4$ and $SrAl_4$ with strong electron correlations [3,4]. Both materials crystallize in the tetragonal $BaAl_4$ structure type with space group I4/mmm. For $EuAl_4$ we have found that the incommensurate CDW has orthorhombic symmetry with superspace group Fmmm(0 0 s)s00 (No. 69.1.17.2), while the periodic basic or average structure remains tetragonal I4/mmm [3]. We will discus the mutual influence of CDW order and magnetism, as present in $EuAl_4$, and of the CDW without magnetism, as found in $SrAl_4$.

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