Extreme magnetoresistance in the regular semimetal LuAs

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We report on a study of magnetotransport properties of a novel non-magnetic semimetal LuAs that crystallizes in a simple rock-salt structure. Through a set of transport experiments in transverse and longitudinal fields, we found that lutetium arsenide has similar magnetotransport characteristics as those of nearly compensated semimetals LaSb, LaBi, and YSb with the very same crystalline structure respecting inversion symmetry. This holds especially true for a near-quadratic extremely large magnetoresistance (XMR close to 400 000 % at 60 T and 5 K) without any sign of saturation and a field-induced up-turn in the resistivity followed by a plateau at low temperatures. In contrast to the aforementioned semimetals, the results of first principles calculations indicate that the band crossing between pnictogen p states and non-magnetic lanthanide d states near the X point is absent in LuAs. This narrows a number of possible scenarios proposed to explain a near-quadratic XMR behavior, specifically those based on nontrivial band topology appear to be inapplicable.

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