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Magnetotransport properties of nearly-free electrons in two-dimensional hexagonal metals and application to the Mn+1AXn phases

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— We propose a general model for explaining the weak field magneto-transport properties of the Mn+1AXn phases in their crystalline form. By using this model to describe the magnetotransport properties of nearly-free electrons in two-dimensional hexagonal metals, we modify it so as to be applicable for Mn+1AXn phases. It is demonstrated that the values of the in-plane Hall coefficient and magnetoresistance are due to the specific shape of the Fermi surface of almost two-dimensional hole and electron bands. If the contribution of the electron pockets to in-plane resistivity can be predicted to be a minor one, in contrast, both holes and electrons should substantially contribute to the overall value of the in-plane Hall coefficient. The relevance of this model is then supported by elementary considerations, analytical computations and a set of experimental data obtained from single crystals of V_2AlC and Cr_2AlC as a function of temperature and magnetic field, both in the basal plane and along the c-axis.

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