РАЗНОЕ

Isosbestic point formation on transverse magnetoresistance curves for strongly correlated quantum matter

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The phenomenon of isosbestic point (IP) is still the subject of debates [1]. This effect manifests itself, when the family of non-monotonic curves of some physical quantity $f(x, y)$ intersects in a narrow region or even in single point with changing of parameters. A typical example of IP is the temperature behavior of heat capacity $C(T)$ measured at different values of magnetic field H [1]. Sometimes except H an external pressure P, chemical pressure x or local interaction strength U may be considered as additional control parameter. Later crossing effects were also detected for T-evolution of Seebeck coefficient, elastic moduli, sound adsorption, spin-lattice relaxation rate, etc.

In current work we study the formation of isosbestic point on the curves of transverse magnetoresistance (TMR) measured at temperatures 1.7–300 K, in magnetic fields up to 8 T. Experiment has been performed on high quality single- and polycrystalline samples of several objects with different transport and magnetic properties, including $Ce_3Pd_{20}Si_6$ heavy-fermion metal

[ρ(300 K)/ρ_0 = 1.2], $YbB_{5.96}$ non-magnetic narrow-band semiconductor [ρ(1.7 K)/ρ(300 K) = 1.8], and ferromagnet $SmCoC_2$ [ρ(300 K)/ρ_0 = 1.7], antiferromagnet NdB_6 [ρ(300 K)/ρ_0 = 4.3], magnetic Weyl semimetal with field-induced *A*-phase $GdCoC_2$ [ρ(300 K)/ρ(2 K) = 2] and metallic system with isolated Ce impurity $Ce_{0.01}La_{0.99}B_6$ [ρ(300 K)/ρ_0 = 2.5]. Mentioned materials were grown by different procedures: standard arc-melting ($Ce_3Pd_{20}Si_6$), vertical crucible-free inductive zone melting ($YbB_{5.96}$, NdB_6, $Ce_{0.01}La_{0.99}B_6$) and melting using a toroid high-pressure cell under both high pressure (*P* = 8 GPa) and temperature (*T* = 1500–1700 K) conditions ($SmCoC_2$, $GdCoC_2$). The high quality of crystals and the chemical composition was controlled by scanning electron microscopy, energy dispersive X-ray spectroscopy, and powder X-ray diffraction methods.

Data obtained allow us to register IP of a new type, which is practically coincides with the position of inversion point separating positive ($\Delta\rho/\rho > 0$) and negative ($\Delta\rho/\rho < 0$) regimes of TMR, see the main panel of Fig. 1. The phenomenon, when two characteristic temperatures of different nature practically coincide is very unusual, and they may be considered as one temperature scale (inversive isosbestic point). The example of isosbestic scaling of TMR is presented in the inset of Fig. 1. For qualitative explanation of IP phenomenon two-component model was considered. This model is also applied in nuclear physics, in phenomenological theories of superfluidity and superconductivity, etc. It is based on the concept, that the properties of the system are described by the superposition of two different interpenetrating components/fluids. In the case of magnetoresistance there are several compo-

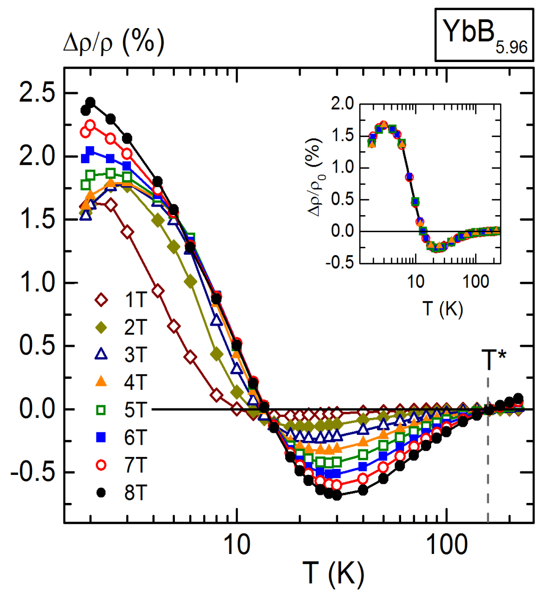

Fig. 1. Temperature scans of transverse magnetoresistance of $YbB_{5.96}$ measured at constant magnetic fields of 1–8 T. The inset presents isosbestic scaling of TMR in the range 4–8 T

nents. Each of them represents a certain scattering mechanism of the charge carriers contributing to the predominance of the positive or negative regime of TMR. In this respect the sign alternative behavior of TMR is determined by the competition between different scattering mechanisms, some of which prevail over others at various temperature intervals depending on the object under investigation. Details are presented in [2].

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Электромагнитные моды кремниевой хиральной метамембраны для терагерцового диапазона

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В последние десятилетие для управления амплитудой, фазой и поляризацией электромагнитного излучения разрабатываются различные метаповерхности. Например, такие компактные, по сравнению с волно-