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Unusual two-dimensional behavior of iron-based superconductors with low anisotropy

Kalenyuk A., Pagliero A., Borodianskyi E., Aswartham S., Wurmehl S., Büchner B., Chareev D., Kordyuk A., Krasnov V.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2017 American Physical Society. We study angular-dependent magnetoresistance in iron-based superconductors Ba1-xNaxFe2As2 and FeTe1-xSex. Both superconductors have relatively small anisotropies γ~2 and exhibit a three-dimensional (3D) behavior at low temperatures. However, we observe that they start to exhibit a profound two-dimensional behavior at elevated temperatures and in applied magnetic field parallel to the surface. We conclude that the unexpected two-dimensional (2D) behavior of the studied low-anisotropic superconductors is not related to layeredness of the materials, but is caused by appearance of surface superconductivity when magnetic field exceeds the upper critical field Hc2(T) for destruction of bulk superconductivity. We argue that the corresponding 3D-2D bulk-to-surface dimensional transition can be used for accurate determination of the upper critical field.

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