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s-wave pairing in the optimally doped $LaO_{0.5}F_{0.5}BiS_2$ superconductor

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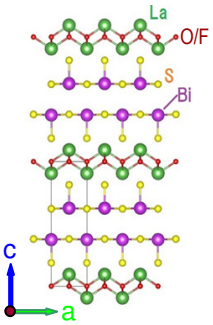
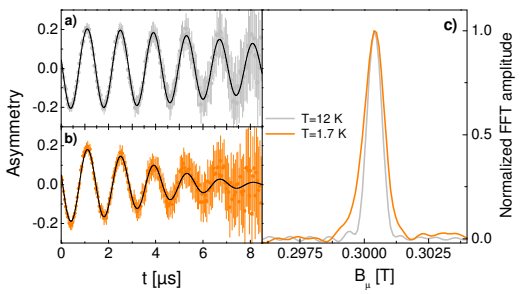


Fig.1: *Crystal structure of $LaO_{0.5}F_{0.5}BiS_2$: the solid line indicates the unit cell. (Y. Mizuguchi et al. J. Phys. Soc. Jpn. 81, 114725 (2012)).*

We report on the magnetic and superconducting properties of the layered compound $LaO_{0.5}F_{0.5}BiS_2$ (Fig.1) by means of zero- and transverse-field (ZF/TF) muon-spin spectroscopy (μSR). These measurements were performed by using both the General-Purpose Spectrometer (GPS) and the Low-Temperature Facility (LTF) on the πM3 beamline of the Swiss Muon Source at the Paul Scherrer Institute, Villigen, Switzerland.
Contrary to previous results on iron-based superconductors, measurements in zero field demonstrate the absence of magnetically ordered phases. TF-μSR measurements were performed by field cooling the sample in the mixed state ($H_{C1}<H_{ext}<H_{C2}$) . In Fig. 2 we show the TF muon-spin precession recorded below and above the superconducting critical temperature (~10 K) and the corresponding local field distribution *P(B)* at muon implantation sites.

The measurement of the muon spin relaxation rate σ_{SC} give access to the superfluid density n_S whose temperature behavior shows a marked *s*-wave character, with $2\Delta/k_BT_c$ very near to the value expected for a phonon-mediated pairing, with possibly an anisotropic gap. The high value of the Ginzburg-Landau parameter, $\kappa(0)$ ~ 85, places this compound in the extreme type-II superconductor family. Finally, the in-plane magnetic penetration depth $\lambda_{ab}(1.7\ K)=484 \pm 3$ nm indicates a very dilute superfluid density, typical of systems with an almost 2D character.



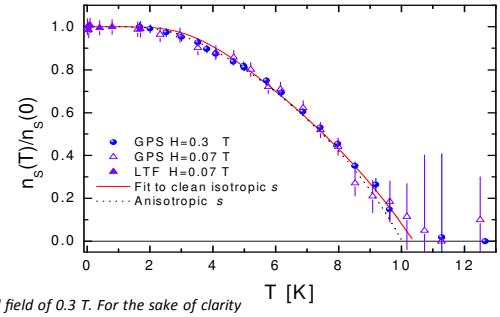


Fig. 2: *TF-μSR asymmetry data collected above (a) and below (b) Tc at an applied field of 0.3 T. For the sake of clarity the time-dependent asymmetry is represented in a 40-MHz rotating frame. (c) FFT real amplitude of the data shown in (a) and (b).*