

Low-Field Cross Relaxation of ^8Li in NbSe_2

M.D. Hossain,¹ Z. Salman,² D. Wang,¹ K. H. Chow,³ S. Kreitzman,² T.A. Keeler,¹ C.D.P. Levy,² W.A. MacFarlane,⁴ R.I. Miller,² G.D. Morris,² T.J. Parolin,⁴ M. Pearson,² H. Saadaoui,¹ and R.F. Kieff^{2,1,5}

¹ Department of Physics and Astronomy, University of British Columbia, Vancouver, BC, Canada V6T 1Z1

² TRIUMF, 4004 Wesbrook Mall, Vancouver, BC, Canada, V6T 2A3

³ Department of Physics, University of Alberta, Edmonton, AB, Canada T6G 2G7

⁴ Chemistry Department, University of British Columbia, Vancouver, BC, Canada V6T 1Z1

⁵ Canadian Institute for Advanced Research, Canada

In this paper, we investigate nuclear spin relaxation near the surface of a single crystal of NbSe_2 using a low energy beam of polarized ^8Li . In low magnetic fields, the $1/T_1$ spin relaxation rate is controlled by the host ^{93}Nb spin dynamics, which produce a fluctuating magnetic dipolar field on the ^8Li . The resulting $1/T_1$ rate shows a Lorentzian dependence on the applied magnetic field, whose width is a measure of the correlation time for the local dipolar field to fluctuate. This may be regarded as a form of cross relaxation in which the ^8Li is used to probe both the $1/T_2$ spin-spin relaxation and $1/T_1$ spin-lattice relaxation rates of the host ^{93}Nb spins. Fig. 1a shows the observed relaxation of the ^8Li with a small magnetic field applied parallel and perpendicular to the surface. Note the sudden upturn in $1/T_1$ below $T_c = 7\text{K}$ for both orientations. The small peak just below T_c with the field is perpendicular to the surface is the superconducting coherence peak. The effect is amplified when the field is parallel to surface by the Meissner screening of the applied field. Combining the results from both orientations, and taking into account the implantation profile, provides a measure the absolute value of London penetration depth. (see Fig. 1b).

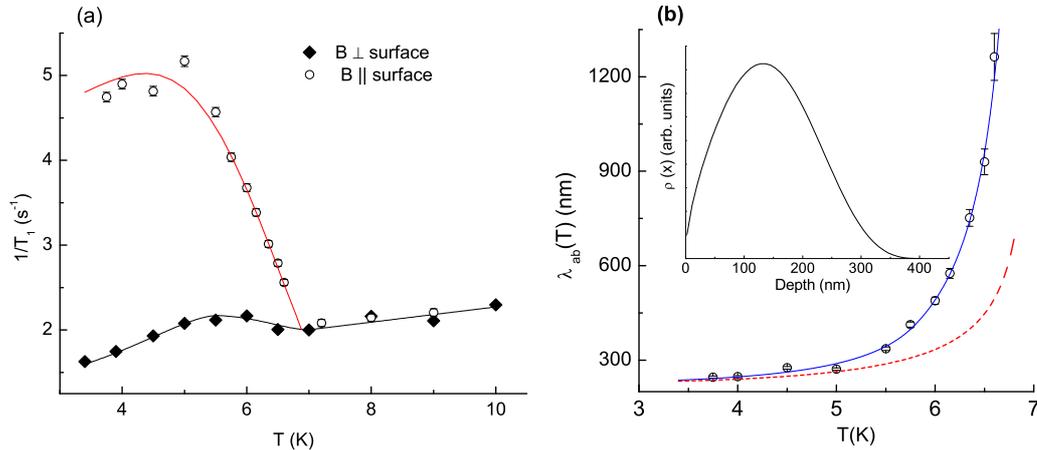


Fig.1(a) The temperature dependence of the $1/T_1$ of ^8Li in NbSe_2 . (b) The magnetic penetration depth λ_{ab} in the Meissner state of NbSe_2 as a function of temperature.