Nonlocal Electrodynamics Effect in Pippard Superconductors

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One of the longest standing problems of experimental superconductivity is quantitative measurements of the in-depth distribution of the magnetic field *B(z)*, *z* being the distance from the sample surface, penetrating into superconductors in the Meissner state. Knowledge of *B(z)* is important for many reasons, in particular it allows to determine the key microscopic intrinsic parameters, such as the London penetration depth $\lambda_L(0)$ and the Pippard coherence length ξ_0. None of these parameters is known with justified uncertainty for *any* superconductor. Taking into account that ξ_0 is dimension of the Cooper pairs, and $\lambda_L(0)$ is directly associated with the Cooper pairs' mass, the measurements of *B(z)* can be viewed as the most direct way for weighing and sizing the Cooper pairs. The field profile *B(z)* can be measured using Polarized Neutron Reflectometry (PNR) and Low-Energy Muon Spin Rotation spectroscopy. Cross measurements of *B(z)* in three Pippard superconductors (Al, In and Sn) with both PNR and LE-μSR techniques are employed in this project. Now experimental part of the project is completed and two papers are in preparation. PNR experiments were performed in the CNBC in winters of 2010/2011 (experiment CNBC-757-A) and 2011/2012 (CNBC-757-B). Results for In and Sn are shown below.

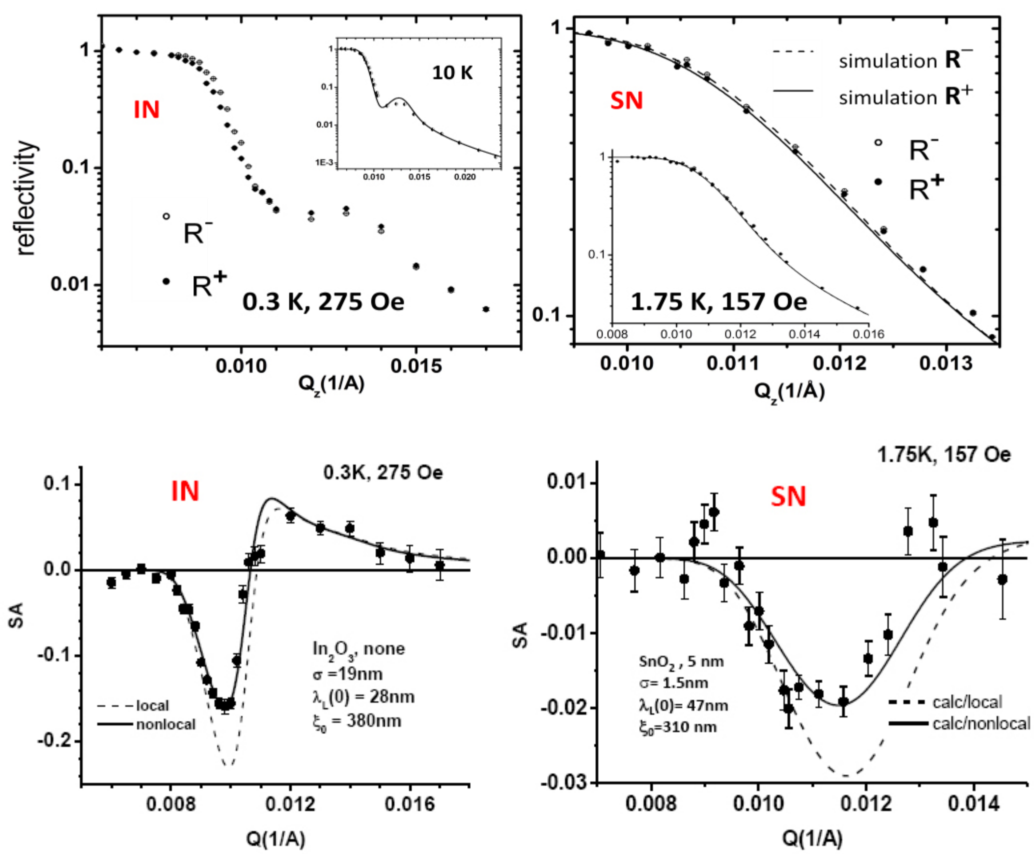

Fig. 1 Experimental data and simulations of the polarized neutron reflectivity and spin asymmetry (SA) for In and Sn. Solid and dashed curves in the graphs for SA are simulations with *B(z)* following from the nonlocal and local theories, respectively.