Centre for Doctoral Training in Condensed Matter Physics

CDT-CMP Seminar Series

2:30pm Tuesday 28th March 2017

'Modern Theory for the Orbital Magnetisation in a Superconductor '

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The compound Sr2RuO4 is widely believed to display chiral p-wave superconductivity below 1.5 K [1]. Such a state intrinsically breaks time-reversal symmetry, leading to a variety of anomalous phenomena including the Kerr effect [2] and orbital magnetisation. In the work presented here, the influence of spin-orbit coupling on the Kerr effect and the orbital magnetisation in the chiral state is investigated. Calculation of the orbital magnetisation in a periodic lattice presents a challenge as the circulation operator r v is not well-defined in the Bloch representation. This difficulty has been overcome in the modern theory for the normal state orbital moment [3]. Here, we show the extension of this theory to the superconducting state. Two distinct contributions to the orbital moment were identified (see Figure) and calculated for Sr2RuO4. Results obtained using this novel formalism suggest that the spin-orbit interaction reduces the on-site orbital moment in the unit cell. Itinerant contributions to the orbital magnetisation of a superconductor are calculated for the first time. The results suggest that the magnitude of the elusive edge current in Sr2RuO4 is below the experimental resolution.

[1] A. P. Mackenzie and Y. Maeno. The superconductivity of Sr2RuO4 and the physics of spintriplet pairing. Rev. Mod. Phys., 75(2):657–712, 2003.
[2] J. Xia, Y. Maeno, P. T. Beyersdorf, M. M. Fejer, and A. Kapitulnik. High resolution polar Kerr effect measurements of Sr2RuO4: Evidence for broken time-reversal symmetry in the superconducting state. Phys. Rev. Lett., 97(16)(167002), October 2006.
[3] T. Thonhauser, D. Ceresoli, D. Vanderbilt, and R. Resta. Orbital magnetization in periodic insulators. Phys. Rev. Lett., 95(13)(137205), 2005.

The seminar will take place in 3W 4.1, University of Bath and via video link to the Access Grid Rom 3.29, Physics, University of Bristol

If you would like to meet with the speaker before the seminar please contact cdt-cmp@bristol.ac.uk

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