Department of Physics
Condensed Matter Physics
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UNIVERSITY OF OXFORD

CONDENSED MATTER SPECIAL SEMINAR

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Simpkins Lee room

"Superconducting spintronics: from earliest results to current challenges"

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The generation of spin-polarized (spin-triplet) Cooper pairs of electrons at the interface between superconductor (S) and ferromagnet (F) materials has been demonstrated by various groups over the past two decades [1-5]. These experiments have paved the way for the research field currently known as superconducting spintronics (superspintronics) – which aims at exploiting spin-triplet superconducting currents in S/F hybrids to do spintronics with low-energy dissipation.

Technological applications based on superspintronics, however, appear still difficult to develop. One reason for this is because spin-triplet pairs must be driven out of equilibrium to do work such as, for example, exerting spin-transfer torque on a F. A second reason is related to the limited number of functionalities and forms of control which superspintronic devices currently have.

In this talk, I will describe the current challenges and open questions that superspintronics is facing. I will then present some recent results obtained by our group that suggest the possibility of generating spin-triplet pairs using material systems different the conventional three-dimensional (3D) S/F thin film multilayers used to date. The superspintronic systems that we are investigating include chiral molecules coupled to S materials [6] and van der Waals S/F heterostructures [7]. These systems are not only interesting from a fundamental point of view, but also because they can help engineer superspintronic devices with novel functionalities and forms of control.

References

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Host: Prof Paolo Radaelli