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Spintronics under control?

Superconducting vortices manipulate spin and charge

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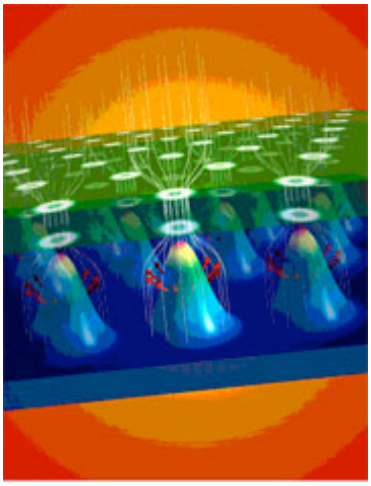

The SC (green) and DMS (blue) hybrid structure. The white field lines illustrate the vortex lattice phase in the SC, which in turn generates the array of spin (red arrows) and charge textures (bell-shaped structure). Figure courtesy of João de Sá Bonelli; www.joaobonelli.com.

Spintronics — the use of the spin of an electron as well as its charge to store and control information in electronic devices — holds great promise for increased data-processing capacity in the ever smaller and faster devices being developed today. Now, Berciu, Rappoport and Jankó report in *Nature* a fast and efficient process that can be used to create and manipulate spin textures and currents[1] — one of the drawbacks to date in the effective development of spintronic systems. The authors propose a hybrid of superconductors (SCs) and diluted magnetic semiconductors (DMSs) to manipulate the local spin and charge textures formed in the DMS by the magnetic flux bundles (vortices) penetrating the SC when in a magnetic field (see Figure). As long as the vortices move slowly so that the Doppler shift in the bound state energy is smaller than the binding energy, the charge and spin texture adiabatically follows a moving vortex. The vortex therefore acts as a 'tweezer', such that control of the position of the vortices in turn controls the spin and charge textures in the DMS. This hybrid system has great potential in applied and basic condensed matter physics.

References

1. Berciu M., Rappoport T. G. & Jankó B. Manipulating spin and charge in magnetic semiconductors using superconducting vortices. *Nature* **435,** 71–75 (2005) Article

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