# Researchers create conveyer belt for magnetic flux vortices in superconductors

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If blown up in size, it would not have a chance in the car factory, but the microscopic conveyer belt built by Simon Bending's team in the Department of Physics at the University of Bath and collaborators in Japan and the USA, could just be the next big thing for improving devices relying on the elusive properties of superconductors (*Nature Materials*, Advanced Online Publication March 12 2006). It's not your standard rubber band on cylinders though – it moves in an erratic way, a quick jolt to the left, a smooth slide to the right. Who would want to be on such a thing?

Tiny swirls of electric currents, it seems. These so-called vortices are the closest things to 'hurricanes' for the superconducting researcher and engineer, and no less threatening. That's because the zero resistance to current flow in even the best superconductors breaks down once vortices enter and start to move around. Their motion can also lead to unpredictable 'noise' if it takes place near the most sensitive regions of superconducting devices. Bending has now shown that it is possible to move vortices around inside a superconductor almost at will using his shaky conveyer belt. In this way they can either be removed entirely or at least left where they cause the least harm.

The asymmetry in its movement is the key to success, since it ensures that the vortices all move in one direction, even though the belt itself moves back and forth. The reason behind this is that the vortices can only follow along during the smooth slides to the right, and not during the jolts in the other direction. The conveyer belt thus acts in some sense as a rectifier, just like the diodes known from electronics.

The mind-boggling part is now that the conveyer belt is assembled out of a line of vortices itself, created and controlled by a time-varying magnetic field. As the researchers show, this way "bad" vortices can be completely removed out of targeted regions inside the superconductor, and the vortices induced to create the conveyer belt can be readily removed from the sample afterwards if need be.

Using this trick, superconducting devices, such as filters for telecommunications or ultra-sensitive magnetic field probes, could be improved by removing vortices - naturally caused by the earth's magnetic field or man-made disturbances – from regions critical to device operation.

Source: University of Bath

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