

# Theory and Experiment Collide: Discovery of Phenomenon Important for Future Application of 'Spintronics'

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A few years ago a University of Missouri-Columbia professor and his student had a theory, and a few weeks ago a physicist in California proved it. The unusual part is that neither person knew about the work of the other. The work has important applications for the future design of electronic devices using the "spin" instead of the "charge" of an electron.

"It was a complete surprise. They didn't know about our work and we didn't know about them," said Giovanni Vignale, MU professor of physics, who worked with Irene D'Amico, assistant professor at the University of York in the United Kingdom, who was Vignale's student at the time. "They didn't know about our work and we didn't know about them. Generally, a theorist gives an idea to an experimentalist and they are aware of each other from the beginning."

The D'Amico-Vignale theory was originally met with skepticism. Their theory on 'spin coulomb drag' was in *Physical Review* in 2000 and *Europhysics Letters* in 2001. D'Amico and Vignale theorized about the behavior of the spin of electrons in semiconductors. Vignale said 'spintronics' is considered a hot field for the future of electronic devices. Computer memories are based on electric charge and need continuous power input. A spintronic device would make computer memories as permanent as a hard drive, Vignale explained, but faster, more flexible and efficient. A spintronic device would literally do away with boot-up times on computers.

"If you want to design spintronic devices then you have to take the 'spin Coulomb drag' into effect," Vignale said.

The validation for D'Amico and Vignale's work came from Joe Orenstein and his colleagues at Lawrence Berkeley National Laboratory. They discovered the effect that D'Amico and Vignale called 'spin Coulomb drag' and recognized its importance for the future design of spintronics. A search revealed that D'Amico and Vignale had not only anticipated this idea but also had formed a quantitative theory of spin diffusion. The theory and the experiment matched.

The two parties met at a physics meeting in Los Angeles this year, where Vignale was told there was a certain presentation he really should not miss. Orenstein's presentation came as a complete surprise to Vignale, who said he was gratified by the validation of his work.

"We were doing something quite different when we came up with this, as always," Vignale laughed.

Orenstein's work was published in the most recent issue of *Nature*.

Source: University of Missouri (By Jennifer Faddis)

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