Quantum computing with braids in flatland

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Exotic anyon quasiparticles trapped in two dimensional sheets can entangle into braided structures that are less susceptible to the disturbances that disrupt individual quasiparticles in quantum computations.

When confined to a 2-dimensional sheet, some exotic particle-like structures known as anyons appear to entwine in ways that could lead to robust quantum computing schemes, according to research appearing in the November 1 issue of the journal *Physical Review B*. The physicists at Bell Laboratories who performed the research are hopeful the anyons can be induced to follow paths that twist into braids that would be much more resistant to disturbances that corrupt data and calculations in quantum computers relying on individual particles.

The anyons the researchers believe they have created are not true particles that can exist on their own, like electrons or protons. Instead anyons are quasiparticles that exist only inside a material, but move in ways that resemble free particles. When trapped in a flat sheet, the anyons braids can store quantum information or interact with other anyon braids to perform quantum calculations.

Although braids in three dimensions unravel easily, braids trapped in two dimensions can't pull apart, which means they're able to withstand disturbances that would scramble the data and calculations in other quantum computers. Although creating braided anyons is difficult, the braids would allow quantum computers to dispense with the complications of error prevention and correction methods most competing quantum computers will probably require.

It's not entirely clear whether the researchers have succeeded in producing braided anyons yet, but as Kirill Shtengel (University of Caligornia, Riverside) points out in a Viewpoint article in the November 1 edition of *APS Physics*, the new research is a major step forward on the path to discovering strange quasiparticles that could help revolutionize computers and lead to a host of novel quantum mechanical experiments.

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