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Domain walls in magnetic nanowires

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Magnetic domain walls are regions where the magnetization rotates from one direction to another inside a material. They are used in modern technologies to encode information, to perform logic operations, and even in lab-on-a-chip applications. In this talk I will discuss our recent analytic theories for predicting the shape of domain walls in very small rectangular nanowires, with cross-section on the order of 3x50 nm. These theories are shown to match very well with numerical calculations and with experimental results. The analytic theory therefore is an accurate tool for experimentalists in this field to use to predict domain wall shapes in various materials. Depending on the aspect ratio and material a nanowire is made from, either a so-called "Bloch" or "Neel" domain wall will form. The situation is even more complicated when interfacial Dzyaloshinkii-Moriya (asymmetric exchange) interaction occurs in a material. A rich phase diagram of domain wall types will be presented.