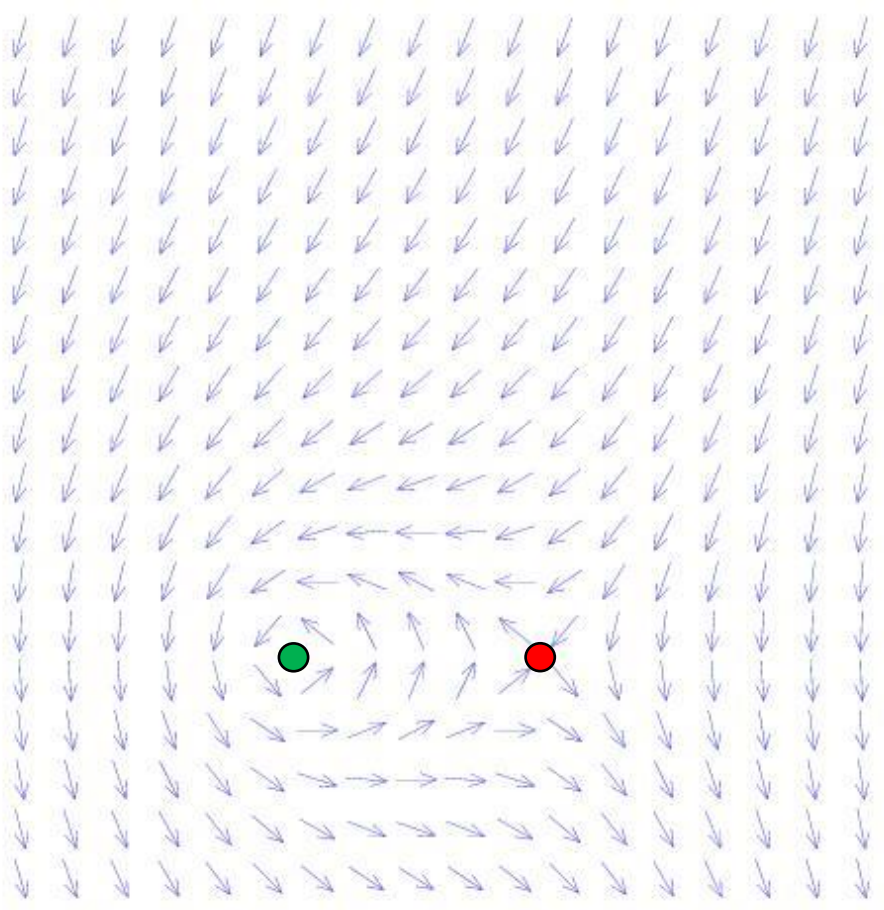
Topological phase transitions and topological phases of matter

An overview of the 2016 Physics Nobel Prize



Dr. Gary Wysin

March 13, 4:30-5:30 p.m.
Cardwell 102

The 2016 Nobel Prize in Physics was given to D.J. Thouless, J.M. Kosterlitz and D. Haldane for their work leading to a theoretical understanding of unusual quantum phases of matter in superconductors, superfluids and magnetic films and chains. The properties of these materials are due to the quantum mechanical behavior of large numbers of atoms. The theories use topological concepts. Topology refers to some geometric property of the whole collection of atoms, that might not be directly visible, but exhibits itself in electrical or magnetic or energetic properties. These phenomena were studied originally in thin layers and chains of atoms, or flatlands, where physics works differently than in three dimensions.

Recently, new topological insulators and metals are being studied and will certainly have curious properties. The hope is that new topological materials can be used to develop new generations of electronics and superconductors, and even quantum computers.

This talk will give an idea of what topology means for these physics problems. It includes an introduction to unusual effects such as vortices in superconductors and thin-film magnets, the vortex-unbinding phase transition, the quantum Hall effect, and why integer and half-integer spin chains behave differently.