Physics 243 -Special Topics in Solid State Physics - Topological Phases

Course Contents:

* Mathematical preliminaries : homotopy groups, fiber bundles, Berry phase, Dirac's charge quantization argument

* Topological defects : vortices, hedgehogs, etc.

* Integer quantum Hall effect : Laughlin's argument, edge states, Chern number, Kubo formula and quantization of Hall conductance.

* Topological insulators : invariants and edge structure

* Fractional quantum Hall effect : model wavefunctions, fractional charge and statistics

* Topological superconductors in 1d and 2d, Majorana fermions and the Moore-Read Pfaffian state

* Some aspects of topological quantum computation.