

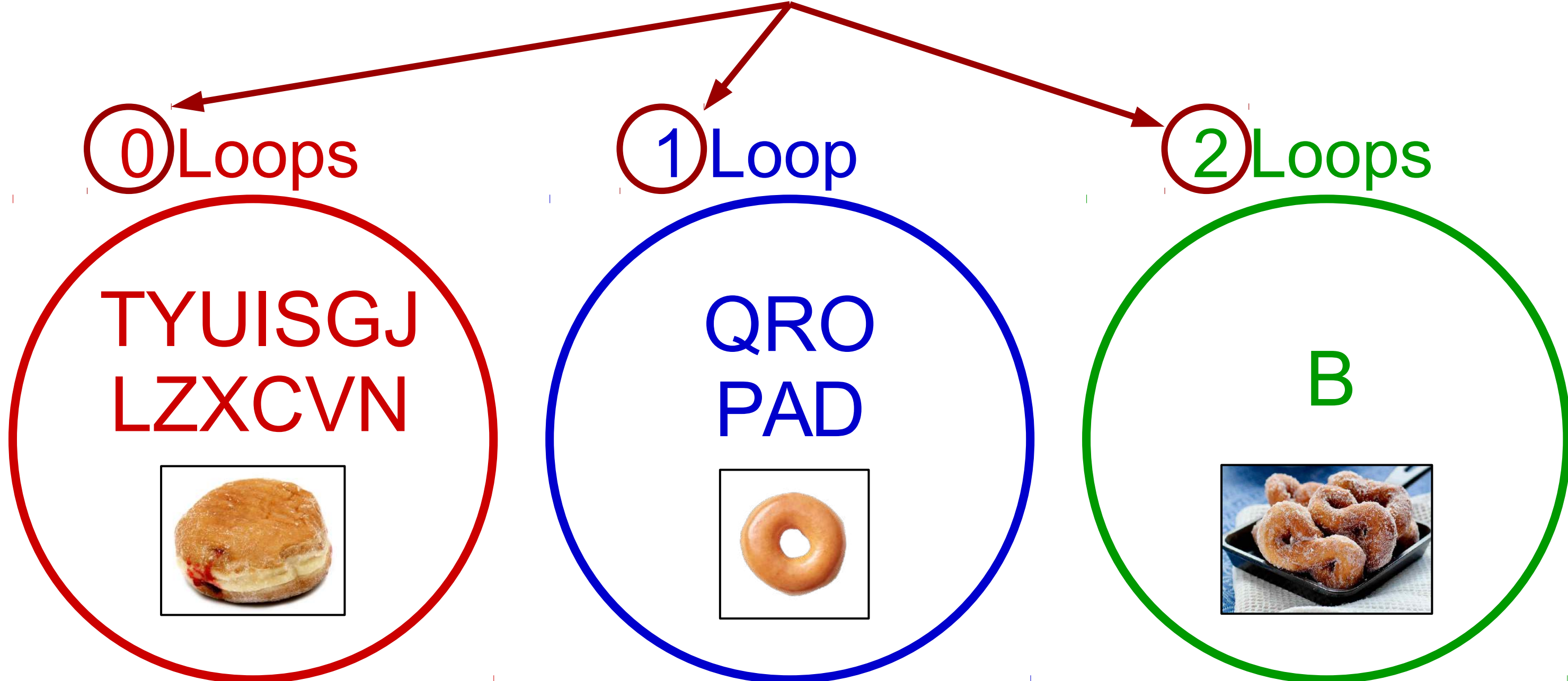
TOPOLOGY IN CONDENSED MATTER PHYSICS: THE QUANTUM HALL EFFECT

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TOPOLOGY

Studies 'topological invariants': properties of a system that do not change under continuous changes of the system.

"Topological invariant"

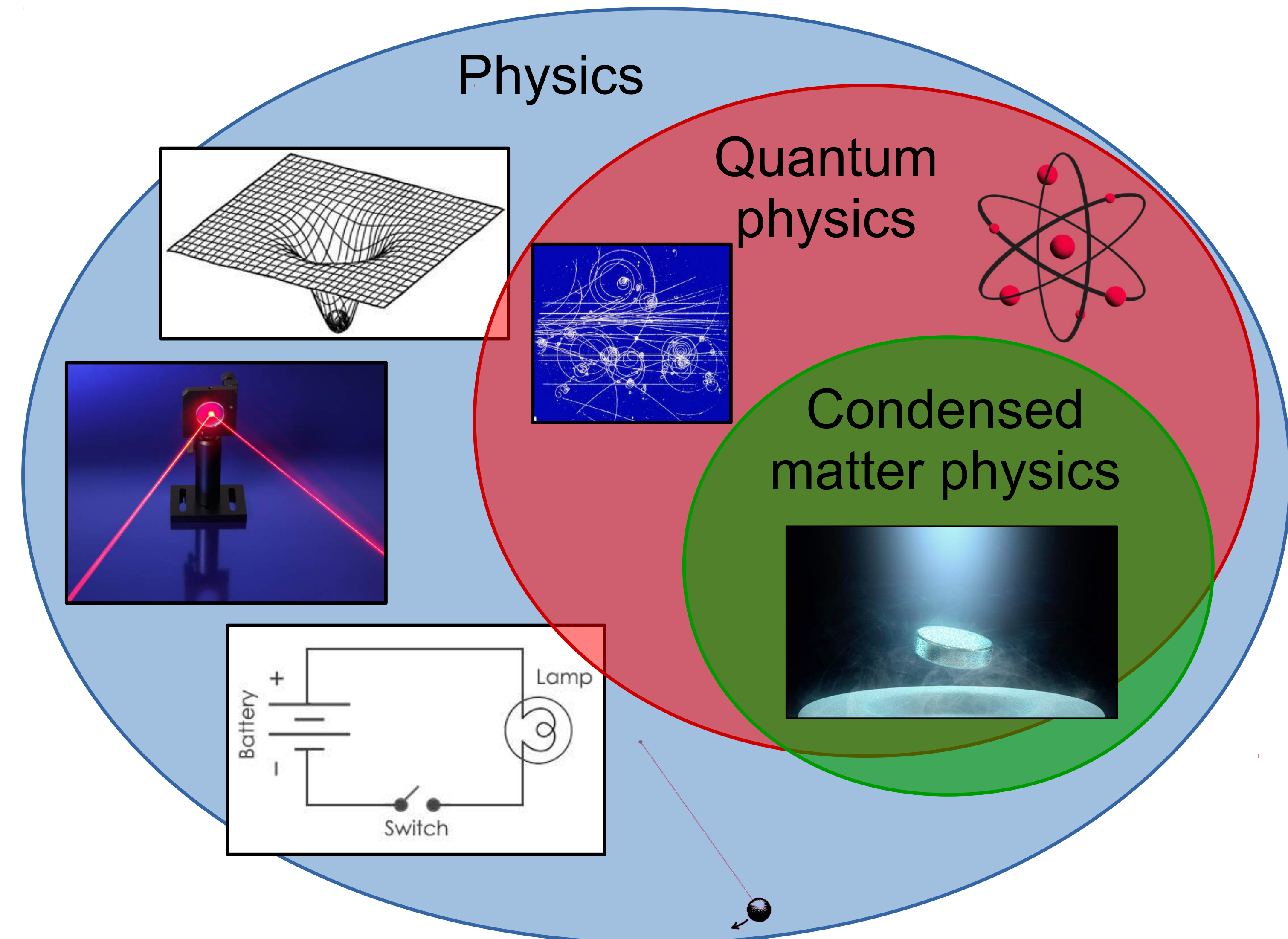


Within a group, letters can be changed into each other without changing the number of loops.



In topology, a doughnut and a coffee cup are the same object.

CONDENSED MATTER PHYSICS

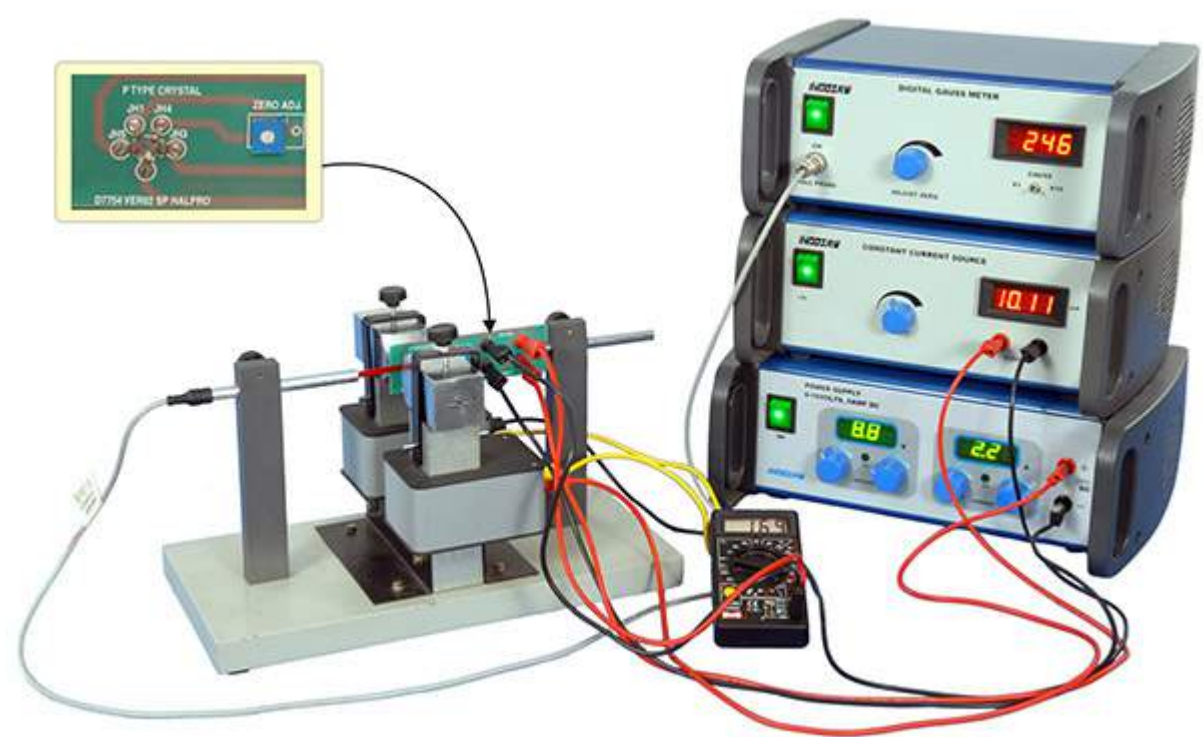
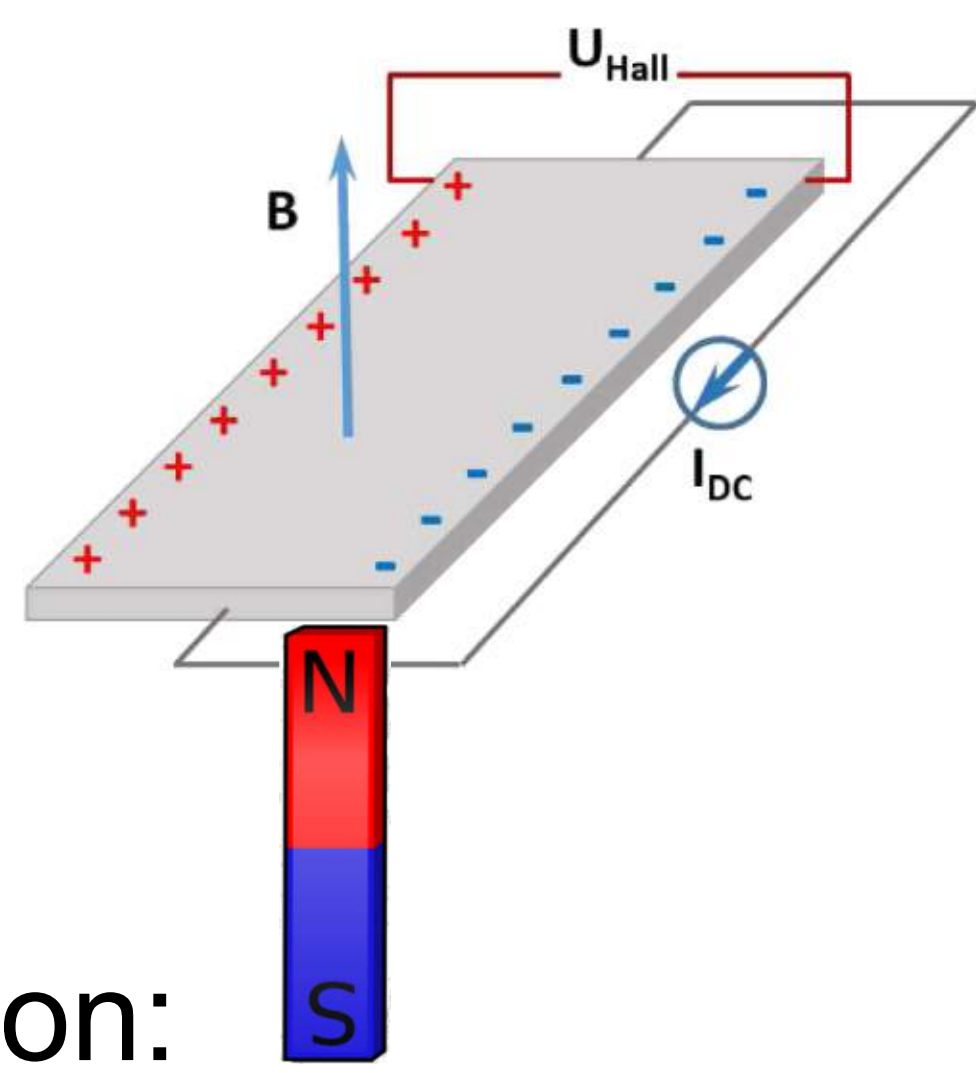


Studies the physical properties of matter; specifically collective properties (analogous to a school of fish).



THE HALL EFFECT

1. Pass current through material.
2. Introduce a magnetic field.
3. Measure "Hall voltage" perpendicular to current *and* field.



- Explanation:
1. Lorentz force bends current.
 2. Charge builds up at edges.
 3. Charge induces voltage.

One expects $U_H \propto B$, a linear dependence. But, at low temperatures and high fields: plateaux! This is the *quantum hall effect*.



1985: Von Klitzing, "For the discovery of the quantized hall effect".



1998: Tsui & Störmer (with Laughlin), for the fractional effect.

QUANTUM HALL EFFECT

