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Title:	Berry phase effects in insulators, superconductors and metals
Authors:	Gawande, Shreekant
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Abstract:	Since its discovery, Berry phase has played an essential role in many branches of physics. It has a natural connection to wide range of ideas, including gauge theories, particle physics, topological materials, magnetotransport, including Hall effects. We study Berry phase in different types of materials: insulators, superconductors, metals and semimetals. We demonstrate topological characterization using Berry phase with the help of SSH Model. We then investigate spinless attractive sawtooth chain and show that the system hosts both trivial and non-trivial topological phases. We then discuss how Berry phase can also be relevant non-gapped systems where Berry phase effects can be seen in electronic properties of materials, predominantly through anomalous velocity correction. We study magneto-transport in spin-orbit coupled Hamiltonian using semiclassical Boltzmann theory. We then study extension to the magneto-transport quantities with the help of Weyl semimetal.
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