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## **Berry curvature in topologically non-trivial quantum systems**

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Berry's phase has recently turned out to be one of the most important quantities in the field of Solid State Physics. It is a quantum mechanical phase of a geometric origin that emerges when some parameters become time-dependent and are subjected to a cyclic and adiabatic evolution in the parameter space. Through the well-known Chern-Gauss-Bonnet theorem, some specific type of Berry's phase is a topological invariant, and at the same time is directly related to certain response functions (such as the Hall conductivity), with the experimental consequence that it is so robust that it can be used as a criterion of existence of non-trivial topological states in modern materials, such as Topological Insulators. In this work, we review the basic applications of Berry curvature (a crucial byproduct of Berry's geometric analysis) in the newly discovered topological materials. We include not only the standard Chern number (the integer that appears in the Chern-Gauss-Bonnet topological invariant – and, experimentally, in the Integer Quantum Hall Effect), but also some of our recent observations on other topological invariants as well, such as the Gauss linking number (describing the linking of Berry flux tubes, some type of Berry tangles that may appear under suitable conditions). An updated discussion of all known topological invariants is presented that reveals the richness of both topology and quantum physics.

### **Biography**

Georgios Konstantinou is a PhD Graduate student in the University of Cyprus.

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