Quantum geometry: how to picture bound electrons in infinite lattices

Raquel Queiroz

Columbia University, New York, USA

Raquel.queiroz@columbia.edu

The concept of quantum geometry has been at the forefront of condensed matter physics, starting from how quantized Berry curvature leads to quantized Hall conductivity, anomalous velocities in Dirac metals, or other topological responses in a growing list of topological materials. Recently, the real part of the quantum geometric tensor - the quantum metric - has also been suggested to play an important role, both in response and in the tendency for materials to assume correlated ground states at low temperatures. In this talk, I will give a local picture of quantum geometry to create an intuition about what it is and when it is essential, relating it to how bonds are formed in infinite lattices.

Figures

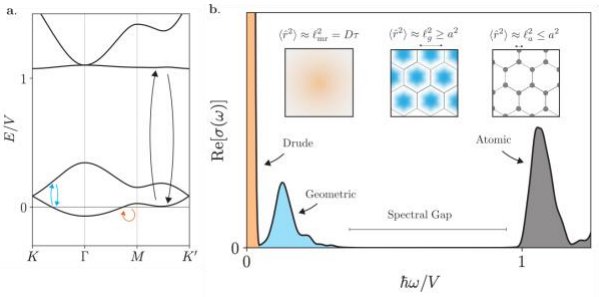

Figure 1: Geometry originates from interband dipole fluctuations.

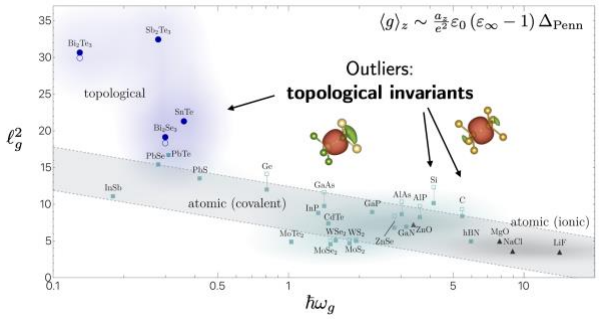

Figure 2: Geometric scales in insulators and topological obstructions.

References

[1] Komissarov, Holder, RQ, Quantum geometric origin of capacitance in insulators, **Nat.Comm. 15, 4621(2024)**

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