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Electronic interactions and band geometry: a subtle relationship

Since the 1980s, physicists have come to realize that N>1 N-band structures can harbor, even when adiabatic, properties inherently different from a single band situation. These properties can be traced to two geometric quantities named the quantum metric and the Berry curvature, both describing a geometry of information associated to the band structure. These give rise to a plethora of new phenomena, and form a fertile ground from which the celebrated topological phases of matter largely form. However, these results are based on the hypothesis that the material has a perfect crystalline structure. The interplay of such perturbations with band geometry and topology still holds many secrets. This interplay is the subject of this talk. We will actually see that this relationship goes both ways. Taking the example of superconductivity as a correlated phase, we show that the normal state's band geometry has a subtle influence on the superconducting state. While the Berry curvature seems to work against superconductivity, the quantum metric seems to work for it. If time permitting, we will see the influence of electronic interactions on band geometry and topological phases, and again we will take a glance at its subtlety.

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