

Quantum criticality

or

How tornados can help to find new land

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Finding new land expands the horizon. The same is true for new phases of matter. I will discuss the rich landscape of strongly correlated quantum materials and their fascinating properties, using heavy fermion compounds as a particularly versatile platform to explore them [1]. Hotspots of attention are quantum critical points and the fans (or tornados) of quantum critical behavior emerging from them. They guide one's way to delineate the different quantum phases. But they are also of great interest in their own right for they defy description in established frameworks such as Fermi liquid theory. Furthermore, quantum critical fluctuations promote the formation of new "emergent" phases such as unconventional superconductivity. I will also describe how this physics is further enriched by the presence of nontrivial electronic topology – a new frontier in the field – and point to the potential for future quantum devices.

[1] S. Paschen and Q. Si, Quantum phases driven by strong correlations, *Nat. Rev. Phys.* **3**, 9 (2021); The many faces (phases) of strong correlations, *Europhys. News* **52/4**, 30 (2021).