The quantum metric of electrons with spin-momentum locking

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Quantum materials are characterized by electromagnetic responses intrinsically linked to the geometry and topology of the electronic wavefunctions. These properties are encoded in the quantum metric and Berry curvature. While Berry curvature-mediated transport effects such as the anomalous and nonlinear Hall effects have been identified in several magnetic and nonmagnetic systems, quantum metric-induced transport phenomena remain limited to topological antiferromagnets. Here we show that spin-momentum locking -- a general characteristic of the electronic states at surfaces and interfaces of spin-orbit coupled materials -- leads to a finite quantum metric. This metric activates a nonlinear in-plane magnetoresistance that we measure and electrically control in 111-oriented LaAlO3/SrTiO3 interfaces. These findings demonstrate the existence of quantum metric effects in a vast class of materials and provide new strategies to design functionalities based on the quantum geometry.