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Optical study of low-dimensional materials

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Electrons in monolayer graphene are described by massless Dirac electrons, which exhibit unique quantum phenomena due to the pseudospin and Berry phase of the massless electrons. In this talk, I will discuss our effort in probing massive Dirac electrons in gapped bilayer graphene, which can be described by a quantum valley Hall insulator with non-trivial Chern number for individual valleys. A topologically protected 1D conducting channel was predicted to exist at the layer-stacking domain boundary of AB-BA bilayers. We show that near-field infrared imaging provides a versatile tool to visualize the layer stacking domain walls, and demonstrate conducting channels arising from the quantum valley Hall edge states through electrical transport in gapped bilayer graphene.