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Dirac Cone Metric and the Origin of the Spin Connections in Monolayer Graphene BO YANG, Institute of High Performance Computing — There have been extensive efforts in modeling the strain and ripples of the monolayer graphene sheet in the form of the effective gauge fields, both from a microscopic point of view and from the quantum field theoretical (QFT) approach used in treating Dirac spinors moving in a curved space (M.A.H. Vozmediano et.al, Phys. Rep. 496, 109, F. Guinea et.al, Nat. Whys. 6, 30). With the QFT approach, it is argued that the metric from either the two-dimensional manifold of graphene sheet or from the in-plane strain field introduces a spin connection that couples to the sublattice pseudospin. Yet the microscopic origins of such an analogy, and the nature of the "spin connection" that couples to the sublattice pseudospin, was not clear. We solve this issue by showing that the modulation of the hopping amplitudes in the honeycomb lattice of the monolayer graphene uniquely defines a metric which corresponds to the geometry of the Dirac cone. This effective metric is different from the real space metric of the crystal lattice, and is entirely the property of the fermi surface. We show how the exact spin connection of this momentum space effective metric field can be calculated from the microscopic tight-binding Hamiltonian, and discuss its experimental implications.

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