Effect of interactions on two-dimensional Dirac fermions HUAIM-
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The University of Hong Kong, SHIPING FENG, Beijing Normal University — Based
on the two-dimensional π-flux model, we study the interaction effects both in non-
trivial massive and massless Dirac fermions with the numerical exact diagonalization
method. In the presence of the nearest and next-nearest neighbor interactions: For
a nontrivial massive Dirac fermion, the topological phase is robust and persists in
a finite region of the phase diagram; while for the massless Dirac fermion, charge-
density wave and stripe phases are identified and the phase diagram in the (V1,V2)
plane is obtained. When the next-next-nearest neighbor interaction is further in-
cluded to massless Dirac fermion, the topological phase expected in the mean-field
theory is absent. Our results are related to the possibility of dynamically generating
a topological phase from the electronic correlations.

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