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Fermion-bags and a new origin for a fermion mass

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Recent developments have shown that the fermion bag approach is a powerful method to solve fermion lattice field theories using Monte Carlo methods. Some sign problems that had remained unsolved earlier can now be solved within this approach. In this work we argue that the fermion bag approach also gives new insight into the mechanism of fermion mass generation. We discuss how chiral condensates can form in most traditional four-fermion models involving staggered lattice fermions although symmetries forbid them. Interestingly, we also discover the existence of models where fermions acquire a mass although the chiral condensate remains zero. In these models fermion masses seem to arise purely due to dynamical reasons rather than due to spontaneous symmetry breaking.

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