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Vacuum misalignment and vector-like quarks in composite Higgs models

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Two major ingredients of a composite Higgs model are vacuum misalignment and partial compositeness. The former is essential to trigger the electroweak symmetry breaking, while the latter can explain the mass hierarchy of the quarks. The partial compositeness mechanism employs a mixing between the SM quarks and vector-like quarks, arising from a new confining sector, via four-Fermi operators. We demonstrate the necessity of these four-Fermi interactions to misalign the vacuum of the strong sector leading to electroweak symmetry breaking and connect our observations with recent results from lattice gauge theory calculations. We also discuss the current status and future prospects for searching vector-like quarks via their non-standard decay channels at the LHC.

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