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Sp(4) lattice gauge theory with fermions in multiple representations

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We study a four-dimensional lattice gauge theory with fermions transforming as the fundamental and anti-symmetric representations of $Sp(2N)$ gauge groups. More specifically, we consider the case of $N=2$ with two and three Dirac flavors for the fundamental and antisymmetric fermions, respectively, whose continuum limit serves as the microscopic theory for $SU(4)/Sp(4)$ models of composite Higgs and top-partial compositeness. The standard Wilson gauge action and Wilson-Dirac fermions are used for the Euclidean formulation of the theory. We discuss the phase structure of the lattice theory, where we find strong evidence of a first-order bulk transition in the strong coupling regime. We also present a preliminary investigation of the mass spectrum of composite states including the Chimera baryon, a baryonic state composed of valence fermions in the two different representations, in addition to spin 0 and 1 (flavored) mesons.

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