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SO(4) invariant Higgs-Yukawa model with reduced staggered fermions

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We explore the phase structure of a four dimensional SO(4) invariant lattice Higgs-Yukawa model comprising four reduced staggered fermions interacting with a real scalar field. The fermions belong to the fundamental representation of the symmetry group while the three scalar field components transform in the self-dual representation of SO(4). The model is a generalization of a four fermion system with the same symmetries that has received recent attention because of its unusual phase structure comprising massless and massive symmetric phases separated by a very narrow phase in which a small bilinear condensate breaking SO(4) symmetry is present. The generalization described in this paper simply consists of the addition of a scalar kinetic term. We find a region of the enlarged phase diagram which shows no sign of a fermion condensate or symmetry breaking but in which there is nevertheless evidence of a diverging correlation length. Our results in this region are consistent with the presence of a single continuous phase transition separating the massless and massive symmetric phases observed in the earlier work.

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