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What if ⊠4 theory in 4 dimensions is non-trivial in the continuum?

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Traditionally, scalar $\phi 4$ theory in four dimensions is thought to be quantum trivial in the continuum. This tradition is apparently well grounded both in physics arguments and mathematical proofs. Digging into the proofs one finds that they do not actually cover all physically meaningful situations, in particular the case of multi-component fields and non-polynomial action. In this work, I study multi-component scalar field theories in four dimensions in the continuum and show that they do evade the apparently foregone conclusion of triviality. Instead, one finds a non-trivial interacting theory that has two phases, bound states and non-trivial scattering amplitudes in the limit of many components. This has potentially broad implications, both for the foundations of quantum field theory as well as for the experimentally accessible Higgs sector of the Standard Model.

Collaboration / Activity

None

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