Contribution ID: **875** Type: **Parallel session talk**

(In)stability of the Higgs vacuum from the O(N) model at large N

Friday 19 July 2024 17:15 (15 minutes)

The theory of an independent Higgs field is given by an O(N) model with an N-component scalar $\vec{\phi}$ and a quartic $\lambda(\vec{\phi}\cdot\vec{\phi})^2$ potential when $N=4$. The phase structure of the theory can be studied analytically for all values of the coupling λ using the large-N limit, both at zero and finite temperature. However, authors in the 70s and 80s argued the theory at large N was "sick" and "futile", and dismissed the theory. This was based on two points: (1) a failure to identify the stable phases and vacuum of the theory and (2) the issue of a negative bare coupling $\lambda<0$ in the UV. We demonstrate that the theory is not, in fact, "sick". Issue (2) is dealt with through the modern understanding of PT-symmetric non-Hermitian theories with "wrong-sign" couplings. Issue (1) is resolved by realizing that the true vacuum has no spontaneous symmetry breaking (SSB) and that the SSB phase only becomes preferred at high temperatures.

Alternate track

1. Formal Theory

I read the instructions above

Yes

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