

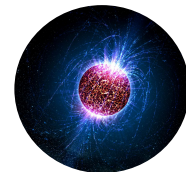
# The phase diagram of hot and dense QCD

by Martin Pospiech with Jens Braun and Marc Leonhardt

New Frontiers in QCD - Yukawa Institute for Theoretical Physics - June 11th 2018

Goal:

QCD phase diagram from first principles  
and equation of state of dense matter for  
astrophysical applications



[Casey Reed - PSU]

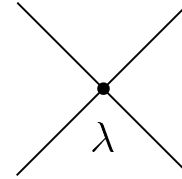
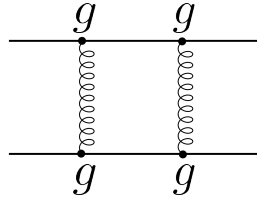
Tool:

Functional Renormalization Group  
(Wetterich equation)

Here:

*Fierz*-complete NJL-type study at finite  
temperature and quark-chemical potential

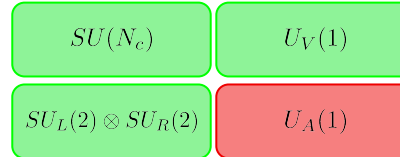
From QCD:



All couplings compatible with symmetries are generated in RG flow

Caution: Fierz ambiguity!

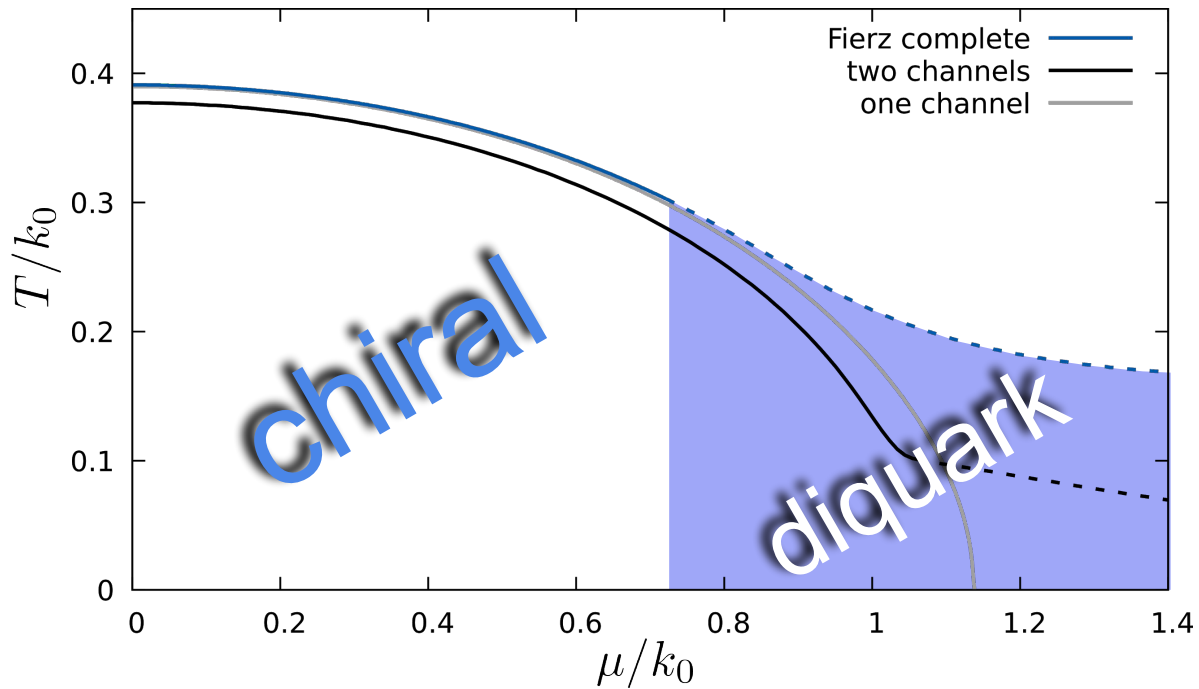
$\mathcal{L}_{(V+A)_{\parallel}}, \mathcal{L}_{(V+A)_{\perp}}, \mathcal{L}_{(V-A)_{\parallel}}$   
 $\mathcal{L}_{(V-A)_{\perp}}, \mathcal{L}_{(V+A)_{\parallel}^{\text{adj}}}, \mathcal{L}_{(V-A)_{\perp}^{\text{adj}}}$   
 $\mathcal{L}_{(\sigma-\pi)}, \mathcal{L}_{\text{csc}}, \mathcal{L}_{(S+P)_{-}}, \mathcal{L}_{(S+P)_{-}^{\text{adj}}}$



Fierz-complete set of four-quark interactions

Investigate spontaneous symmetry breaking within purely fermionic theory

[Braun, Leonhardt, MP '18]



*Curious?*

Number 9