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Large particle number expansion in relativistic and non-relativistic (conformal) field theories

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概　要

Strongly-coupled theories are interesting yet in general hard to solve. We are however not completely doomed as some interesting physical quantities are still computable. Even in the absence of the weak-coupling parameter, a QFT might have a limit sector where it might become solvable. The limit of large global charge is one instance of this -- the charge density introduces a new scale into the system and so one can write down an effective field theory whose counting parameter is the inverse of the charge itself. The physics behind the computation is not very complicated as it is the same as computing the energy of superfluid condensate, for example.

In this talk, I will review this method (for brevity we call this the large charge expansion), first invented to study unitary Fermi gas (which is a non-relativistic CFT, NRCFT) by Son and Wingate in 2005 and later rediscovered by myself and collaborators in 2015 to study generic relativistic non-supersymmetric and supersymmetric CFTs. I will summarise what can be learned about various CFTs and NRCFTs from the large charge expansion, such as the possibility of inhomogeneous superfluid at large global charge, the various phases realised when one adds angular momentum to the superfluid condensate at large charge, or the treatment of the droplet edge of the unitary fermi gas.

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