
Contribution ID: **2** Type: **not specified**

# Modification of Compact Star Observables due to Quantum Fluctuations

*Wednesday 20 September 2017 11:20 (40 minutes)*

We present the application of our technique to obtain equation of state (EoS) by the Functional Renormalization Group (FRG) method presented earlier. Using the expansion of the effective potential in a base of harmonic functions at finite chemical potential we can provide a general framework for the calculation of the EoS. Within this theoretical framework we determined the equation of state and the phase diagram of a simple model – as a proof-of-concept. To illustrate this we used the simplest, non-trivial case, where massless fermions coupled to scalars through Yukawa-coupling at the zero-temperature limit.

We compared our results to the 1-loop and the mean field approximation of the same model and other high-density nuclear matter equation of states. We found a $10 - 20\%$ difference between these approximations. As an application, we used our FRG-based equation of states to test the effect of the quantum fluctuations in superdense nuclear matter of a compact astrophysical object. To illustrate the magnitude of this effect, we calculated the mass-radius relation for a compact star using the Tolmann-Oppenheimer-Volkov equation and observed a 5% effect in compact star observables due to quantum fluctuations.

## Type of contribution

Talk

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