Correlation Effects in Graphene Nanoribbons: A Functional RG Analysis

In recent years theoretical and experimental works on graphene have gained a lot of interest. Although correlation effects play an important role in experiments not many theoretical approaches have been applied to study these effects in graphene. Most of them are mean-field approximations.
A method that was used very successfully in recent time to study correlation effects is the functional renormalization group (fRG). The fRG has especially been used to study correlated quantum dots. For small systems like the Anderson model a good agreement with data from exact methods was found.
The aim of my diploma thesis is to find an answer - or at least a hint to an answer - to the question whether the fRG is a useful method to investigate correlation effects in graphene.
The systems we focused on are rectangular graphene nanoribbons of finite size at zero temperature. These are coupled to leads to determine transport properties.
In my talk I will first explain the theoretical approach. This contains a short overview and explanation of the formulas that are used to determine the interesting quantities and a brief introduction into the fRG method. Afterwards the numerical outcome of our calculations will be presented for different system sizes and interactions. In this part I will give a comparison to results from self-consistent Hartree-Fock and solutions obtained by exact diagonalization, as well.