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Theoretical Nuclear Physics

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Abstract

Nucleus is a complex many-body system. Theoretical understanding of the nuclear properties is a challenging task. The mean field concept is the most useful practicle approximation and provides the first step towards the solution of the complex nuclear many-body problem. In this project the mean field concept is described and its application to some illustrative examples (Harmonic oscillator, Hydrogen atom, Shell model) is demonstrated. The Hatree-Fock theory which is also a mean field theory where the mean field is obtained self consistently is presented. To improve upon the mean field one needs to take into account the left over interaction. This leads to the concept of configuration mixing. It is applied to the example of Ni^{58} as an illustration. The future perspectives are indicated at the end of the project.