

# Course on Many Particle Physics

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## I. CONTENTS

1. Introduction to second quantization
2. Interacting electron gas and failure of perturbation theory
3. Zero-temperature Green's function (Dyson series and Feynman diagrams)
4. Exact diagonalization of Interacting fermions and bosons (Hubbard model, Heisenberg model, etc)
5. Finite-temperature Green's functions and imaginary-time formulations
6. Analytical continuation
7. Path-integral formulations of many-body systems
8. Integrating out degrees of freedom and effective actions
9. Renormalization Group
10. Kondo model and heavy-fermion materials
11. Dynamical mean-field theory
12. Parton construction approaches to strongly correlated systems
13. Bosonization and Luttinger liquids

## II. REFERENCES

- Alexander L. Fetter and John Dirk Walecka, *Quantum Theory of Many-Particle Systems*, Dover Publications (2003).
- A. A. Abrikosov, L. P. Gorkov, I. E. Dzyaloshinski, Richard A. Silverman, *Methods of Quantum Field Theory in Statistical Physics*, Dover Publications (1975).
- Gerald D. Mahan, *Many-Particle Physics*, Springer (2000).
- Alexander Altland and Ben D. Simons, *Condensed Matter Field Theory*, Cambridge University Press (2010)

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