

# Lecture Overview ...

## Modern Problems in Nuclear Physics I

D. Blaschke (U Wroclaw, JINR, MEPHI)

G. Röpke (U Rostock)



### 1. Path Integral Approach to Partition Function

Ideal quantum gases:

- Scalar fields, neutral and charged, Bose condensate
- Fermionic fields
- Gauge fields and blackbody radiation

Strongly interacting nuclear matter: Walecka model

### 2. Strongly interacting quark matter

NJL model for quark matter: chiral symmetry breaking, color superconductivity ...

Bound states and Mott effect: pions, kaons, nucleons ... Beth-Uhlenbeck EoS

### 3. Basic Green's functions approximations

Ideal gas; Hartree-Fock approximation; Polarization function (RPA)

### 4. Strong correlations in the Green's function approach

Bound states; Cluster expansion; Pairing

# Lecture Overview ...

## Modern Problems in Nuclear Physics II

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1. Physics of Neutron Stars I  
Phenomenology, EoS and Structure (3)
2. Statistical Model and HIC I  
RHIC and CERN Experiments, Chemical Freeze-out (2)
3. Physics of Neutron Stars II – Color superconductivity (2)
4. Statistical Model and HIC II  
NSE, Clusters in Nuclei, HIC & Femto-Nova (3)
5. Superfluidity in Nuclear Matter I  
BEC-BCS Crossover. NSR Theory (2)
6. Superfluidity in Nuclear Matter II – Nuclear vs. Quark Matter, NS Cooling (3)

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## Schedule for the Winter Semester 2019

10.09., 10:15 – 12:30

Lectures

David Blaschke

30.09., 10:15 – 15:00

Lectures

David Blaschke

26.10., 10:15 – 15:00

Lectures

David Blaschke

11.11., 10:15 – 15:00

Lectures

Gerd Roepke

25.11., 10:15 – 15:00

Lectures

Gerd Roepke

09.12., 10:15 – 15:00

Lectures

David Blaschke

**DRAFT**