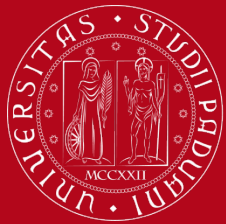




UNIVERSITÀ
DEGLI STUDI
DI PADOVA

MSc in Physics
THEORETICAL PHYSICS OF MATTER

Meeting with students
September 27, 2021



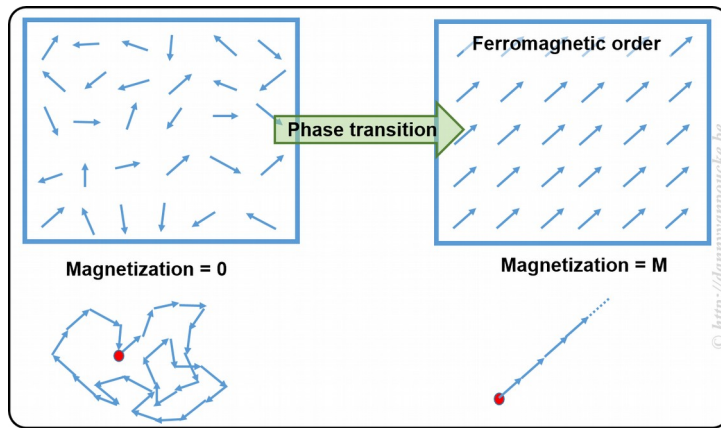
Mandatory for the curriculum “Physics of Matter”(1st year, 1st semester)

Models of Theoretical Physics

Stochastic differential equations and path integrals

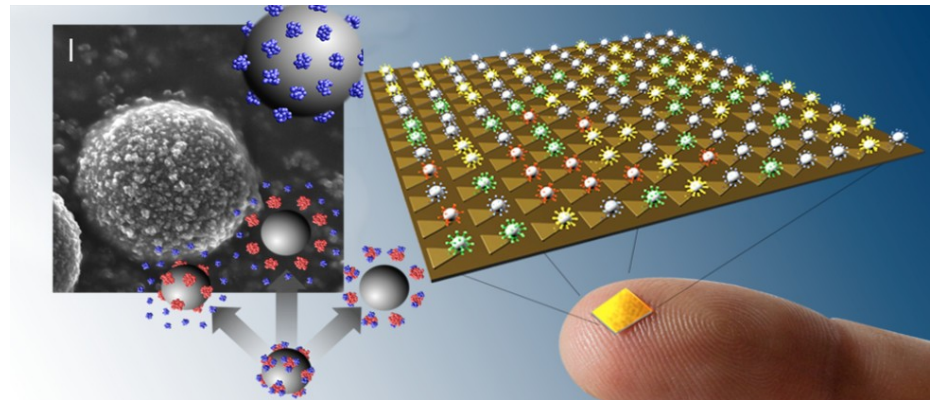
Statistical Mechanics

Phase transitions, critical phenomena, symmetry-breaking, renormalization group



Solid State Physics

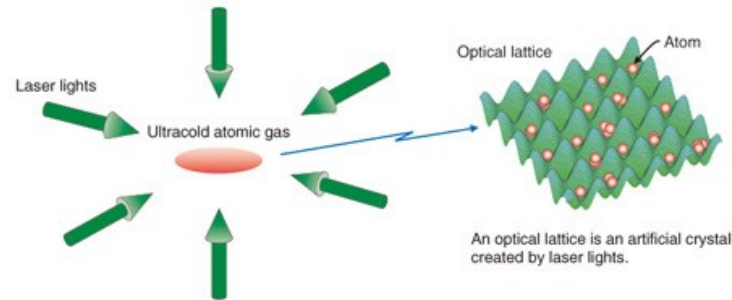
Metals, insulators, semi-conductors, superconductors



Mandatory for the curriculum “Physics of Matter” (1st year, 2nd semester)

Structure of Matter

Quantum physics of light and matter with second quantization



Mandatory for the sub-curriculum “Theoretical Physics of Matter” (1st year, 2nd semester)

Introduction to Many-Body Theory

Non-relativistic quantum field theory of many-body systems with Feynman diagrams

$$W: \text{wavy line} = \text{wavy line} + \text{wavy line} \text{---} \text{blob} \text{---} \text{wavy line} + \text{wavy line} \text{---} \text{blob} \text{---} \text{wavy line} + \dots$$

$$P: \text{blob} = i \text{---} \text{blob} \text{---} \text{blob}$$

$$\Sigma: \text{blob} = \text{blob} \text{---} \text{wavy line} \text{---} \text{blob} + \text{blob} \text{---} \text{wavy line} \text{---} \text{blob}$$

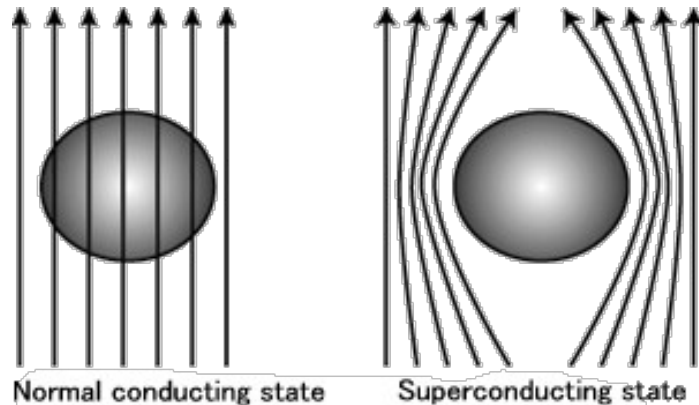
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Strongly suggested for the sub-curriculum
“Theoretical Physics of Matter” (2nd year, 1st semester):

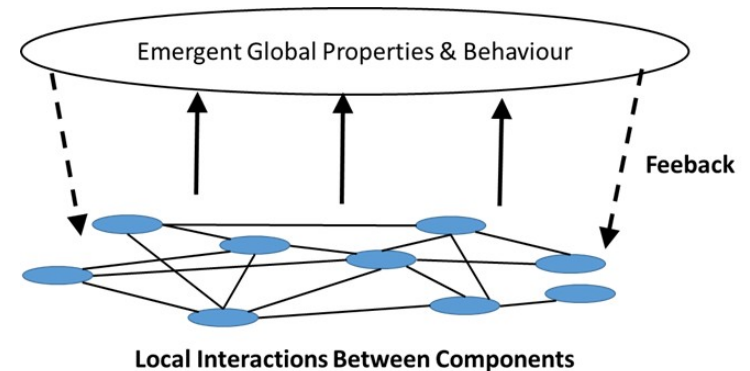
Theory of Strongly Correlated Systems

*Field theory within a functional integral approach
with applications to spin systems, superfluids
and superconductors*



Physics of Complex Systems

*Out of equilibrium statistical mechanics,
disordered systems, networks, biostatistics*





Suggested courses for a MSc thesis in
“Theoretical Physics of Matter”:

- **Theses on Out-of-Equilibrium Statistical Mechanics and Interdisciplinary Topics**
(polymers, theoretical biophysics, theoretical ecology, neuroscience,...)
Physics of Complex Systems (2nd year, 1st semester)
 - **Theses on BEC, Ultracold Atoms, Superconductors, and Graphene**
Theory of Strongly Correlated Systems (2nd year, 1st semester)
Non-perturbative Quantum Field Theory (2nd year, 1st semester)
- **Theses on Ab-Initio Density Functional and Many-Body Theories for Condensed Matter**
Computational Methods for Materials Science (2nd year, 1st semester)
 - **Theses on Quantum Science and Technologies**
Quantum Information (2nd year, 1st semester)

Plus other courses suggested by the supervisor (from the other two curricula of the MSc in
Physis, or from the MSc in Mathematics, or from the MSc in Physics of Data)