Modulbezeichnung:	**Path integrals in many particle and condensed matter physics (PW-PathInt)** (Path integrals in many particle and condensed matter physics)	**5 ECTS**
Modulverantwortliche/r:	Martin Eckstein	
Lehrende:	Martin Eckstein	

Startsemester: SS 2022	Dauer: 1 Semester	Turnus: unregelmäßig
Präsenzzeit: 30 Std.	Eigenstudium: 120 Std.	Sprache: Englisch

Lehrveranstaltungen:

Path integrals in many particle and condensed matter physics (SS 2022, Vorlesung, 2 SWS, Martin Eckstein)

Path integrals in many particle and condensed matter physics (UE) (SS 2022, Übung, 2 SWS, Martin Eckstein)

Empfohlene Voraussetzungen:

Required knowledge:

Quantum Mechanics and Statistical physics. Advanced quantum mechanics (TVA) recommended.

Inhalt:

Short description:

Path integrals provide an elegant alternative approach to formulate quantum mechanics. They are in particular suitable to derive an effective theory for a subset of the degrees of freedom within a larger universe, including the description of a small quantum system which is embedded in an environment, or the derivation of an effective theory for a collective order parameter (such as superconductivity). Path integrals can also can be taken as the basis for computational approaches, such as path integral Quantum Monte Carlo, and they provide a concise way to derive diagrammatic perturbation theory for interacting many particle systems. This lecture should introduce you to the language of path integrals, both for single particle quantum mechanics and for systems of interacting particles and quantum fields.

Topics:

- Path integral formulation of quantum mechanics
- Imaginary time path integrals (statistical physics)
- Path integral Quantum Monte Carlo
- Symmetry-broken phases: Effective theories
- Diagrammatic perturbation theory in the path integral language
- Possibly: Dynamical mean-field theory

Lernziele und Kompetenzen:

Learning goals and competences:

Students

- explain the relevant topics of the lecture
- apply the methods to specific examples

Literatur:

- Alexander Altland and Ben Simons, "Condensed Matter Field Theory", Cambridge University Press.
- Xiao-Gang Wen, "Quantum Field theory of Many-Body Systems", Oxford University Press.

Verwendbarkeit des Moduls / Einpassung in den Musterstudienplan:

Das Modul ist im Kontext der folgenden Studienfächer/Vertiefungsrichtungen verwendbar:

[1] **Physik mit integriertem Doktorandenkolleg (Master of Science)**
(Po-Vers. 2018w | NatFak | Elitestudiengang Physik mit integriertem Doktorandenkolleg (Master of Science) | Gesamtkonto | Physics elective courses | Path integrals in many particle and condensed matter physics)

Dieses Modul ist daneben auch in den Studienfächern "Physics (Master of Science)", "Physik (Bachelor of Science)", "Physik mit integriertem Doktorandenkolleg (Bachelor of Science)" verwendbar.

Studien-/Prüfungsleistungen:

Path integrals in many particle and condensed matter physics (Prüfungsnummer: 71151)

Prüfungsleistung, mündliche Prüfung, Dauer (in Minuten): 30

Anteil an der Berechnung der Modulnote: 100% Prüfungssprache: Englisch

Erstablegung: SS 2022, 1. Wdh.: SS 2022 (nur für Wiederholer)

1. Prüfer: Martin Eckstein