

**KNOWLEDGE REQUIRED**

Basics of Quantum Field Theory  
and Statistical Mechanics.

**DOTTORATO DI RICERCA IN FISICA**

**ANNO ACCADEMICO 2019 - 2020**

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**Applications of the Functional Renormalization Group in Field Theory**

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**Teaching staff**

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**Reception hours:**

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**Program of the course:**

- 1) Phase transitions. Second order phase transitions and critical points.  
Critical manifold and classification of operators. Correspondence with renormalization in Quantum Field Theory. Renormalizability and fixed points.
- 2) Kadanoff-Wilson blocking. Momentum space blocking and Wegner-Houghton equation.  
Flow equation of the Functional Renormalization Group (FRG) and its approximations.
- 3) Infrared regulator dependence. Proper Time RG flow.
- 4) Applications of the FRG to scalar theories in d-dimensions. Drawbacks in gauge theories.
- 5) Tricritical Lifshitz points. Modulated phase. FRG approach.

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**Bibliography:**

- [1] K.G. Wilson, J. Kogut: Phys. Rep. 12 (1974) pgs.75-200.
- [2] J. Berges, N. Tetradis, C. Wetterich: Phys. Rept. 363 (2002) pgs.223-386.
- [3] M. Peskin, D. Schroeder, "Introduction To Quantum Field Theory" (1995) CRC press.
- [4] Course notes.