



Course unit English denomination	Introduction to Bosonization in condensed matter physics
Teacher in charge (if defined)	Luca Dell'Anna
Teaching Hours	24
Number of ECTS credits allocated	3
Course period	02/2025 - 06/2025
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (50% minimum of presence) ☐ No
Course unit contents	An elementary introduction to the technique of Bosonization for 1-dimensional systems and its relevant applications in condensed matter Physics are presented. The main topics of the course are the following: 1) Fermi surface and spectrum of low energy excitations of free spinless fermions. 2) Green's functions of left and right moving Fermi fields. 3) Normal ordering and Tomonaga Hamiltonian. 4) Kac-Moody algebra as a spectrum generating algebra for Tomonaga Hamiltonian. 5) Application to an interacting fermionic system: the Luttinger liquid. 6) Application to a quantum spin chain: Bosonization of the Heisenberg model. 5) Spinful fermions: spin-charge separation and application to Fermi-Hubbard model.
Learning goals	The objectives are: learn the methods and develop the skills necessary to apply these knowledges to the resolution of one-dimensional quantum problems
Teaching methods	Frontal lectures



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Course on transversal, interdisciplinary, transdisciplinary skills	☐ Yes ☒ No
Available for PhD students from other courses	☐ Yes ☐ No
Prerequisites (not mandatory)	
Examination methods (in applicable)	Oral exam
Suggested readings	Course notes
Additional information	