



PERSONAL INFORMATION Michele Pini

Nov 2016 – Feb 2020

PhD in Theoretical and Experimental Physics

Università di Camerino, Camerino (Italy)

Supervisors: Prof. Giancarlo Calvanese Strinati (giancarlo.strinati@unicam.it), Prof. Pierbiagio Pieri (pierbiagio.pieri@unicam.it)

Subject: The purpose of the thesis was the study of an attractive Fermi gas in the normal phase throughout the BCS-BEC crossover by means of diagrammatic approaches based on the t -matrix approximation. The thesis work included (i) a systematic comparison of the effects of different degrees of self-consistency in the t -matrix approach, both for thermodynamic and dynamical quantities, (ii) an investigation on pair correlations in the normal phase, aimed to describe experimental data on the pairing fraction by the group of Prof. J. H. Denschlag, and (iii) the study of thermodynamic properties of a spin-imbalanced Fermi gas.

Mar 2014 – Oct 2016

Master's degree (Laurea Magistrale) in Physical and Astrophysical Sciences – Curriculum Physics of Matter

Università di Firenze, Firenze (Italy)

Grade: 110/110 cum laude

Average exams grade: 30/30

Master Thesis**Title:** Signatures of magnetic crystals in a three-leg ladder system with synthetic gauge fields**Supervisor:** Dr. Davide Rossini (davide.rossini@sns.it)**Co-supervisor:** Prof. Leonardo Fallani (fallani@lens.unifi.it)

Purpose of the thesis: The purpose of the thesis was a theoretical study on the experimental feasibility of magnetic crystals that arise in three-leg ladder fermionic systems in the presence of a synthetic gauge field. In particular, the effects of the harmonic trapping potential and of the interactions between particles were investigated. The study was performed by means of DMRG (Density Matrix Renormalization Group) simulations.

Additional information: This thesis originated from a collaboration between the experimental group of Leonardo Fallani at the University of Florence and the theoretical group of Rosario Fazio at Scuola Normale Superiore in Pisa.

Sep 2010 – Mar 2014

Bachelor's degree (Laurea Triennale) in Physics and Astrophysics

Università di Firenze, Firenze (Italy)

Grade: 110/110 cum laude**Thesis****Title:** Ultracold atoms in optical lattices: numerical solutions and applications in quantum computation

Supervisor: Prof. Leonardo Fallani (fallani@lens.unifi.it)

Purpose of the thesis: The purpose of the thesis was the calculation of the maximally localized Wannier functions for an optical lattice and the hopping and interaction parameters of the Bose-Hubbard model. This was done in order to study the experimental feasibility of a quantum C-phase gate operating on two nearest neighbour sites of the lattice. The program performing the calculation was written in Wolfram Mathematica language.

Sep 2005 – Jun 2010

Secondary school - Liceo Scientifico Castelnuovo (PNI)
Firenze (Italy)

Grade: 100/100

PNI (Piano Nazionale Informatica) class included more hours of Math and Physics than other classes.

PERSONAL SKILLS

Mother tongue(s) Italian

Other language(s)

English

| UNDERSTANDING | | SPEAKING | | WRITING |
|---------------|---------|--------------------|-------------------|---------|
| Listening | Reading | Spoken interaction | Spoken production | |
| B2 | C1 | B2 | B2 | C1 |

Cambridge ESOL Level 1 Certificate – Council of Europe Level B2

Levels: A1/A2: Basic user - B1/B2: Independent user - C1/C2 Proficient user
Common European Framework of Reference for Languages

Scientific skills

- Good knowledge of self-consistent t -matrix diagrammatic theories for the study of a Fermi gas through the BCS-BEC crossover acquired during the PhD.
- Good knowledge of DMRG (Density Matrix Renormalization Group) and TEBD (Time Evolution Block Decimation) methods acquired during the master thesis.
- Good knowledge of the Monte Carlo method and the Metropolis algorithm acquired during the Computational Laboratory class.
- Wide and specialized knowledge of ultracold atoms physics acquired during the "Atomic Physics" and "Physics of Ultracold Atoms" classes of the master's degree.
- Basic experimental skills on spectroscopy and laser characterization acquired during the "Atomic Physics Laboratory" class.

Communication skills

- Ability to perform presentations in English acquired during the master's degree and the PhD.
- Capability to participate in scientific discussions and to establish relationships with other physicists of my field acquired by attending multiple conferences during the PhD (both in Italy and abroad).

Digital competence

| SELF-ASSESSMENT | | | | |
|------------------------|-----------------|------------------|-----------------|------------------|
| Information processing | Communication | Content creation | Safety | Problem solving |
| Proficient user | Proficient user | Independent user | Proficient user | Independent user |

Levels: Basic user - Independent user - Proficient user
Digital competences - Self-assessment grid

ECDL (European Computer Driving Licence) Certificate

- Good knowledge of Fortran 90 programming acquired during the PhD.
 - Good knowledge of C programming acquired during Informatics and Computational Laboratory classes.
 - Good knowledge of Wolfram Mathematica programming acquired during both bachelor and master theses.
 - Excellent knowledge of LaTeX software acquired during bachelor, master and PhD thesis.
 - Good knowledge of Office suite (word processor, spread sheet, presentation software).
- Job-related skills
- Capability to explain physics topics to undergraduate students acquired by working as a tutor in the University of Camerino (about 60 hours of lessons).
- Other skills
- Classified up to the national level of selection of the Olympics of Mathematics as a member of the team of Liceo Scientifico Castelnuovo (2010).
- Driving licence
- B, A2

ADDITIONAL INFORMATION

- Publications
- M. Pini, P. Pieri, and G. Calvanese Strinati, *Fermi gas throughout the BCS-BEC crossover: Comparative study of t -matrix approaches with various degrees of self-consistency*, Phys. Rev. B 99, 094502 (2019).
- T. Paintner, D. K. Hoffmann, M. Jäger, W. Limmer, W. Schoch, B. Deissler, M. Pini, P. Pieri, G. Calvanese Strinati, C. Chin, and J. Hecker Denschlag, *Pair fraction in a finite-temperature Fermi gas on the BEC side of the BCS-BEC crossover*, Phys. Rev. A 99, 053617 (2019).
- M. Pini, P. Pieri, M. Jäger, J. Hecker Denschlag, and G. Calvanese Strinati, *Pair correlations in the normal phase of an attractive Fermi gas*, arXiv:1912.04802 (2019).

Cerreto d'Esi, 08/04/2020



